

Pinto Creek Phase II TMDL Modeling Report



**Arizona Department
of Environmental Quality**

**Malcolm Pirnie, Inc.
4646 E. Van Buren Street, Suite 400
Phoenix, Arizona 85008**

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February 2006

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EXECUTIVE SUMMARY

This report describes the development of a hydrologic and pollutant transport model for the Pinto Creek Basin near Miami and Globe, Arizona. The modeling was performed to support the allocation of a Phase II total maximum daily load (TMDL) for copper discharges to the creek. The Phase II TMDL was initiated to build upon the results of a Phase I TMDL completed by USEPA in 2001, with the advantage of additional water quality, meteorologic, and hydrologic data collected by ADEQ during 2000-2004. This report describes the model construction, calibration, and application to evaluate current and future loads of copper to Pinto Creek.

Pinto Creek is a predominately intermittent stream that drains approximately 183 mi² in Gila, Pinal, and Maricopa counties in east central Arizona. The stream extends approximately 33 miles from its headwaters in the Pinal Mountains to Roosevelt Lake. Although much of the creek length is ephemeral or intermittent, it contains several perennial reaches. The Arizona DEQ has placed a 20-mile segment of Pinto Creek on its 2002 list of water quality limited waters due to exceedances of acute and chronic criteria for dissolved copper.

Due to natural copper mineralization, the basin contains numerous historical mining-related disturbances including open pits, tunnels, waste rock and tailings piles, leach dumps, and milling facilities. The largest mining operation in the basin is the BHP Pinto Valley Mine, although many of the BHP facilities are impounded to prevent discharge to Pinto Creek. Previous monitoring has shown the inactive Gibson mine, located in the upper Pinto Creek basin, to be a major source of copper loads to Pinto Creek. Several other discrete historical mining-related sources discharge copper to Pinto Creek during wet weather conditions.

The Carlota Copper Company has proposed the development of an open-pit mining operation of the Cactus Breccia between Pinto Creek and its tributary, Powers Gulch. In 1997, the U.S. Forest Service completed an environmental impact statement (EIS) and record of decision (ROD) that authorized the proposed action. The Carlota Copper Company subsequently applied for a NPDES permit to discharge stormwater associated with two waste rock disposal areas during storm events greater than the 10-year, 24-hour event. In 2004, the Carlota Company announced to ADEQ its intention to withdraw its application for a NPDES permit and redesign the operations to prevent all stormwater discharges for storms up to and including the 100-year, 24-hour event. In December 2005, the Carlota Copper Company and associated mining operations were purchased by Quadra Mining Ltd.

During 2000-2004, ADEQ conducted a monitoring program to collect water quality, stream stage, and meteorological data in the Pinto Creek basin in support of the Phase II TMDL. Stage-triggered automatic samplers were placed at four stations and water quality samples were collected at these locations under a range of stage conditions. ADEQ also sampled flow and runoff at 44 other locations in the basin, representing a variety of sources and lithologies. Another major source of water quality for assessment and modeling is the BHP ambient monitoring program at six locations in Pinto Creek.

The Hydrologic Simulation Program-Fortran (HSPF) was chosen as the model framework for the Phase II TMDL. The model was calibrated to observed streamflow at two USGS gages in the middle portion of the Pinto Creek basins, and also to streamflow estimates that were derived from stream stage data at ADEQ monitoring stations in the upper basin. Water quality

EXECUTIVE SUMMARY ES

monitoring data were used to developed copper loading factors for background and discrete mining-related sources. Water quality calibration was achieved by adjustment of these loading factors to match observed in-stream dissolved copper concentrations, as well as by the empirical simulation of in-stream dissolved copper losses.

After calibration, the Pinto Creek HSPF model was applied to predict changes in dissolved copper concentrations and loads for a variety of scenarios locations. All scenarios were run for five different stormflow conditions, from a 2-year, 1-hour storm to a 100-year, 24-hour storm. Model scenarios included:

1. Current conditions.
2. Remediation of the Gibson mine.
3. Remediation of the Gibson mine and various other mining related sources.
4. Background/ambient conditions.
5. Implementation of the Carlota mining activity as formulated in 1997 EIS.
6. Implementation of the Carlota mining activity as formulated in 1997 EIS and remediation of the Gibson mine.
7. Implementation of the Carlota mining activity as formulated in 2004 (non-discharging).
8. Implementation of the Carlota mining activity as formulated in 2004 and remediation of the Gibson mine.

The model scenario results led to the following major conclusions:

1. *The Gibson Mine is single largest source of copper loads to Pinto Creek.* Loads from the Gibson mine represent over 90 percent of the total copper load above sample station PC-100 (near old U.S. Highway 60). Remediation of the Gibson mine was found to be necessary to bring portions of the middle basin into compliance with dissolved copper criteria.
2. *Remediation of other mining-sources is also expected to provide water quality benefits to Pinto Creek.* Although much smaller contributors than the Gibson mine, other mining-related sources were predicted to have measurable impacts on in-stream copper concentrations under stormflow conditions. Remediation of these sources (in addition to remediation of the Gibson mine) was predicted to bring portions of the middle Pinto Creek basin into compliance with both water quality standards under most stormflow conditions.
3. *Much of the upper Pinto Creek would exceed water quality criteria even after remediation of mining-related sources.* Despite the large potential reduction in loads and concentrations described above, the model predicted that dissolved copper criteria were unlikely to be met at many locations in the upper and middle Pinto Creek basin, even after remediation of most major mining-related sources. The primary reasons for this are (1) natural background copper loads in mineralized areas; (2) loads from anthropogenic, mining-related sources that are unlikely to be remediated to pristine conditions; and (3) low to moderate hardness values in the upper basin that cause the dissolved copper criteria to be very low.

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4. *The Carlota Copper Project was not predicted to cause large changes in copper loads or concentrations:* This project was predicted to cause an overall reduction in copper loads to the stream by impounding drainage area and reducing the copper loading from the Cactus Breccia formation to Pinto Creek. The model predicted that if the Gibson mine was remediated, implementation of the Carlota Copper Project would cause a slight decrease in the dissolved copper concentrations under most stormflow conditions. There was little difference in model results between the 1997 and 2004 versions of the Carlota scenarios.

Model scenario results are compiled in tabular form, and can be used to develop Phase II TMDL allocations or derive a site specific objective.

INTRODUCTION

This report describes the development of a hydrologic and pollutant transport model for the Pinto Creek Basin near Miami and Globe, Arizona. The modeling was performed to support the allocation of a Phase II total maximum daily load (TMDL) for copper discharges to the creek. The hydrologic and pollutant transport model was developed by Malcolm Pirnie, Inc. in 2004 under contract to the Arizona Department of Environmental Quality (ADEQ). This report describes the model construction, calibration, and application to evaluate current and future loads of copper to Pinto Creek.

1.1 GENERAL SETTING

Pinto Creek is a predominately intermittent stream that drains approximately 183 mi² in Gila, Pinal, and Maricopa counties in east central Arizona (Figure 1-1). The stream extends approximately 33 miles from its headwaters in the Pinal Mountains to Roosevelt Lake. Although much of the creek length is ephemeral or intermittent, it contains several perennial reaches where groundwater is forced to the surface by bedrock constrictions.

The Pinto Creek basin is characterized by thin soils and steep, rugged hills with surface elevations that range between 2100 and 6400 feet above mean sea level (MSL) (Figure 1-2). Due to natural copper mineralization, the basin contains numerous historical mining-related disturbances including open pits, tunnels, waste rock and tailings piles, leach dumps, and milling facilities. The largest mining operation in the watershed is the BHP Billiton (BHP) Pinto Valley Mine, which does not currently extract ore but maintains stockpiles and other facilities. Many of the BHP operations have been impounded to prevent discharge to Pinto Creek during storms smaller than the 100-year, 24-hour events.

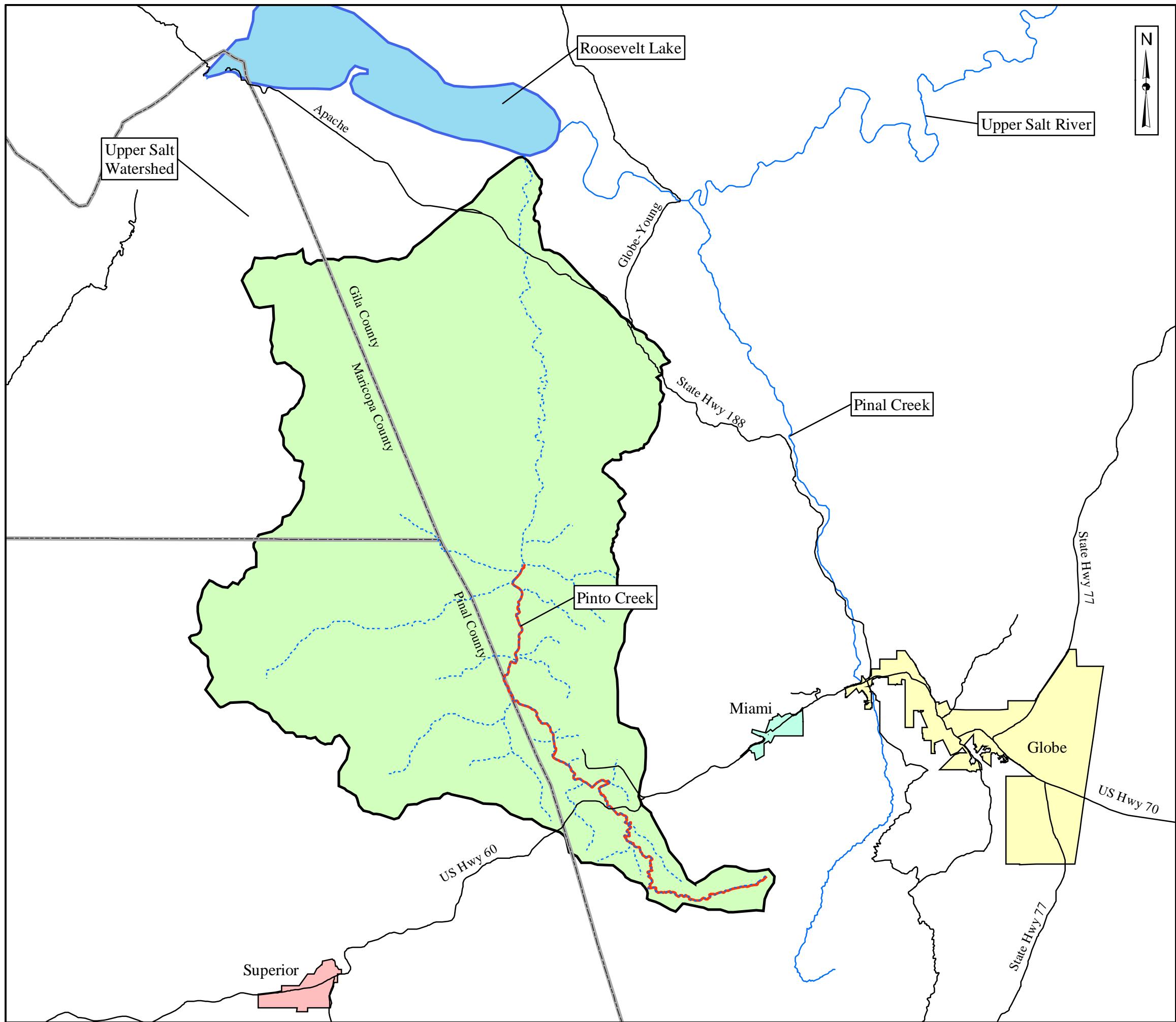
Geology: The headwaters of the Pinto Creek basin are underlain by schist and granite (Figure 1-3). Various other lithologies out crop throughout the basin, including dacite, diabase, and sedimentary rocks of the Apache Group that include sandstones, shales, and limestones. The Cactus Breccia crops out in a small area in and near the Pinto Creek Channel. This ore body has been extensively mined on the east side of Pinto Creek and is the target of the proposed Carlota Copper Project. Portions of the creek channel are underlain by alluvial sediments.

Land Use/Cover: Most of the Pinto Creek Basin (95 percent) consists of undisturbed land that is covered by a mixture of shrub and brush rangeland and evergreen forest, including portions of the Tonto National Forest. The other major land cover is stockpile material from mining, which covers about 5 percent of the Pinto Creek Basin. Buildings, roads, and paved areas represent a minimal portion of the watershed.

1.2 APPLICABLE WATER QUALITY STANDARDS

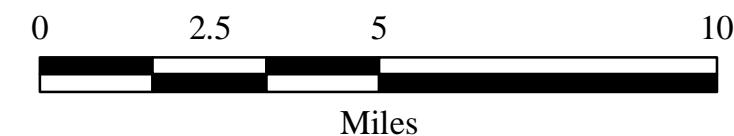
Designated uses of Pinto Creek include:

- ♣ Aquatic and wildlife—warmwater
- ♣ Fish consumption
- ♣ Full body contact



Legend

- 303(d)-listed segment
- Pinto Creek and Tributaries
- Roads, Highways
- Pinal Creek
- Salt River
- County Boundaries
- Roosevelt Lake
- Pinto Creek Watershed



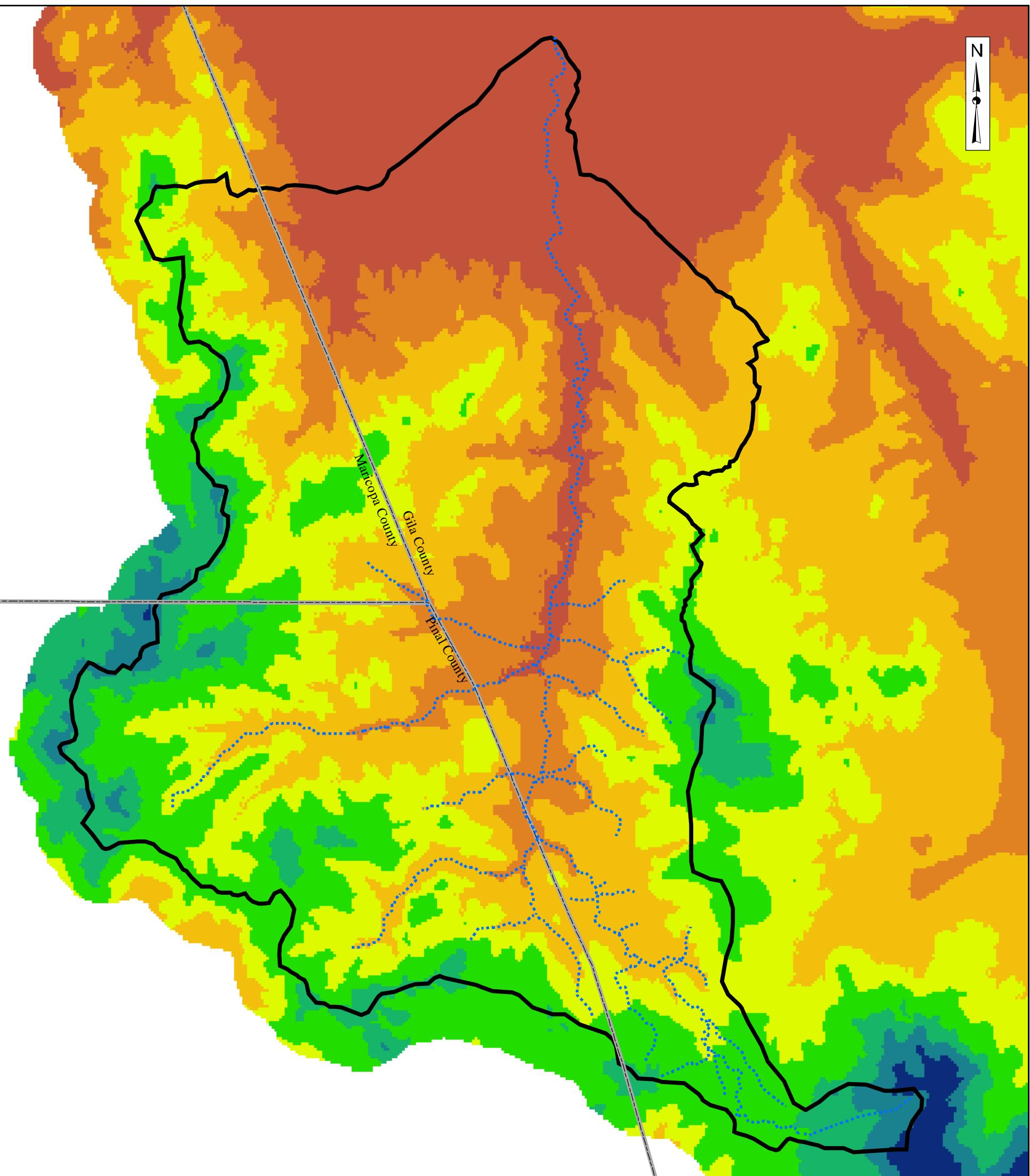
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Study Location Map

Figure 1-1

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Legend

- Pinto Creek and Tributaries
- County Boundaries
- Pinto Creek Watershed

Elevation (ft)

1,998 - 3,000	4,000 - 4,500
3,000 - 3,500	4,500 - 5,000
3,500 - 4,000	5,000 - 5,500
	5,500 - 6,000
	6,000 - 8,000

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Miles

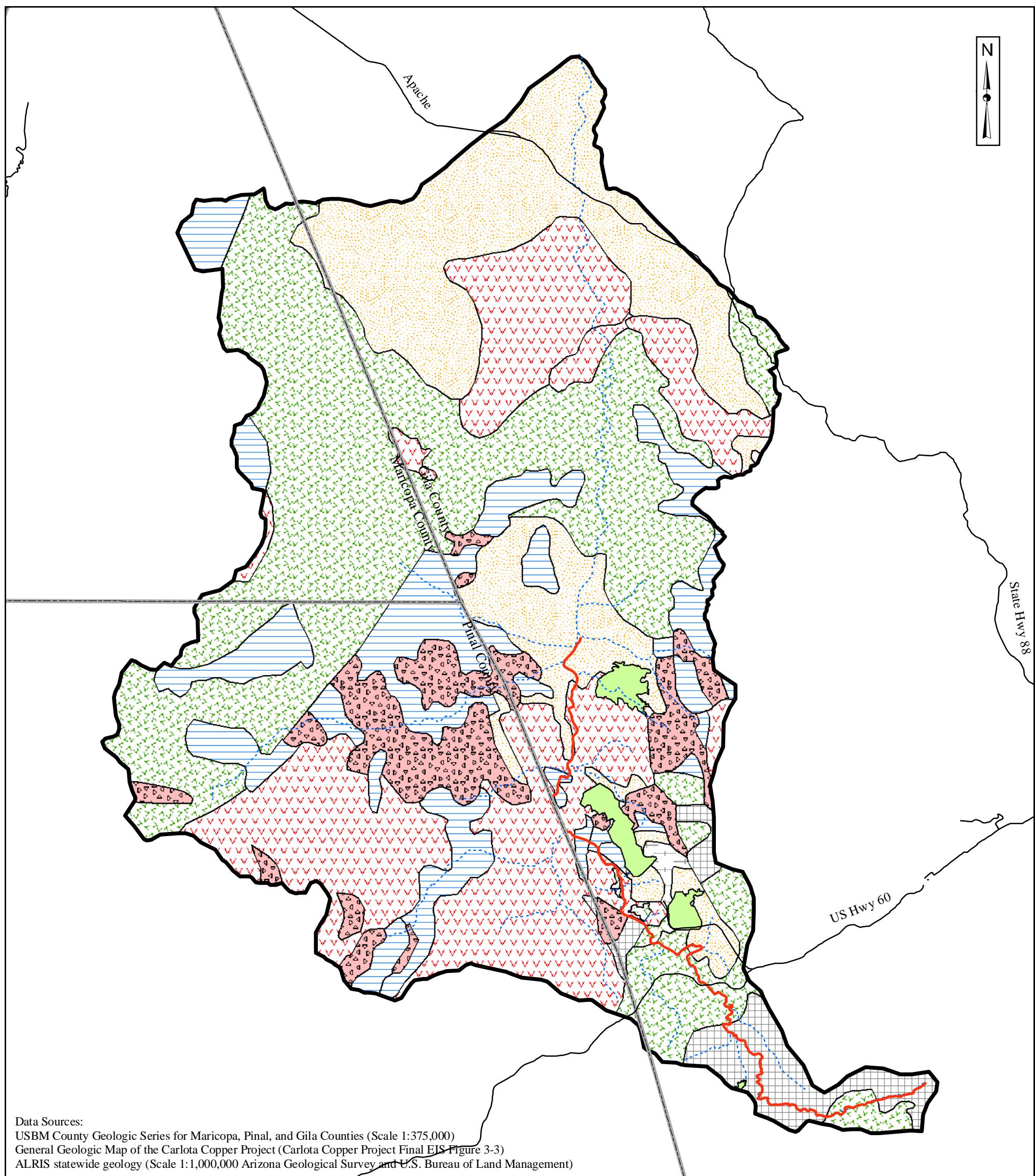
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Topography of the
Pinto Creek Basin

Figure 1-2

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Legend

~~~~ Roads, Highways		Basalt
~~~~~ 303(d)-listed segment		Cactus Breccia
..... Pinto Creek and Tributaries		Dacite
Pinto Creek Watershed		Diabase
County Boundaries		Granite
Surface Lithology		Schist
Alluvium		Tailings
Apache Group		



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**Surface Lithology of the
Pinto Creek Basin**

Figure 1-3

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- ♣ Agriculture—irrigation
- ♣ Agriculture—livestock watering

The Arizona DEQ has placed Pinto Creek on its 2002 list of water quality limited waters due to exceedances of acute and chronic dissolved copper criteria (Table 1-1). The listed section extends from the headwaters to Ripper Spring Canyon (Figure 1-1), a length of approximately 20 miles. Of the designated uses listed above, the aquatic and wildlife—warmwater (A&Ww) use has the most stringent water quality criteria for dissolved copper (Table 1-1). In comparison to these criteria, dissolved copper concentrations have been measured at almost 1,000 µg/L in Pinto Creek and over 5,000 µg/L in tributaries directly below mining-related sources. The dissolved copper criteria for A&Ww use are hardness-dependent and are calculated by the following formula:

$$\begin{aligned} \text{A\&Ww acute dissolved copper criterion: } & (e^{(0.9422 [\ln(\text{Hardness})] - 1.7)}) * (0.96) \\ \text{A\&Ww chronic dissolved copper criterion: } & (e^{(0.8545 [\ln(\text{Hardness})] - 1.702)}) * (0.96) \end{aligned}$$

TABLE 1-1
Dissolved Copper Criteria for Aquatic and Wildlife Uses

Hardness (mg/L as CaCO ₃)	Dissolved Copper Criterion (µg/L)	
	Acute	Chronic
25 ^a	3.6	2.7
100	13.4	9.0
200	25.8	16.2
300	37.8	22.9
400 ^b	49.6	29.3

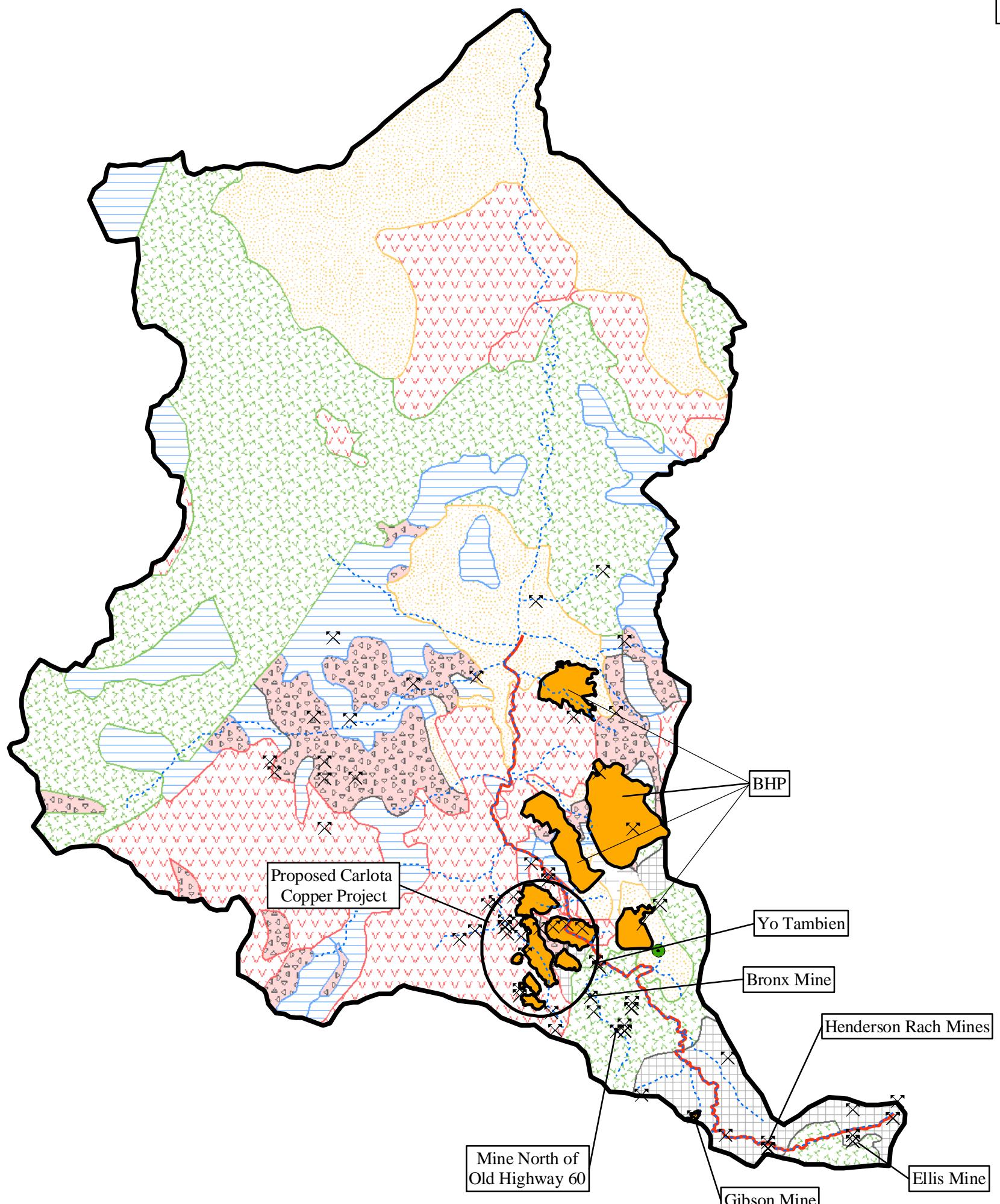
^a Minimum value for hardness adjustment under Arizona water quality standards.

^b Maximum value for hardness adjustment under Arizona water quality standards.

1.3 SOURCES OF COPPER LOADS TO PINTO CREEK

Monitoring data suggest that copper concentrations are naturally elevated in the soils and rocks of the Pinto Creek Basin. The Cactus Breccia ore body, in particular, is a known source of natural copper loading to the creek, as are mineralized portions of the granites, schists, and dacites. However, the natural loading to Pinto Creek has been significantly increased by historical mining activities. Over 50 historical mine workings are known to exist in the basin (Figure 1-4), although most represent small and exploratory efforts. Based on the Phase I TMDL and more recent monitoring data, certain historical mining operations were known or suspected to represent discrete sources of copper loads by their size and nature. These include:

- ♣ Ellis Mine
- ♣ Henderson Ranch Mines
- ♣ Gibson Mine
- ♣ Bronx Mine



Legend

- ✗ Other Mines
 - BHP Outfall 005
 - ~~~~~ 303(d)-listed segment
 - ~~~~~ Pinto Creek and Tributaries
 - ████████ Copper Mines
 - ████████ Pinto Creek Watershed
- | Surface Lithology | |
|-------------------|----------------|
| | Diabase |
| | Alluvium |
| | Apache Group |
| | Basalt |
| | Cactus Breccia |
| | Dacite |
| | Granite |
| | Schist |
| | Tailings |

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Mining-Related Sources	
Figure 1-4	February 2006

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- ♣ Old Highway 60 Mine
- ♣ Yo Tambien Tunnel

The Phase I TMDL concluded that the Gibson Mine is the single largest source of copper loading to Pinto Creek. This facility consists of several acres of mine workings, including adits/shafts, waste rock dumps, leach pads, pregnant leach solution (PLS), and raffinate ponds. The dumps and leach pads contain approximately 150,000 tons of copper-bearing rock, and the PLS pond is known to overflow during storm events. This results in the discharge of copper-laden water to a tributary that enters Pinto Creek approximately 0.9 miles downstream of the mine.

The Ellis Mine is displayed on aerial photography as an area of land disturbance near the headwaters of Pinto Creek, above Simpson Dam. The Henderson Ranch Mines consist of tailings piles and other mine workings adjacent to Pinto Creek, also in the upper portion of the watershed. The Bronx and Old Highway 60 mines are located in the Five Point Mountain Tributary subbasin of Pinto Creek. The Bronx Mine includes an adit that shows evidence of the discharge of copper-laden water during storm events. The Yo Tambien tunnel is located near the Pinto Creek channel, and also show evidence of discharge of copper-laden water from an adit under wet conditions.

Surface water discharge from most of the BHP mining operations are contained by engineering controls. BHP has eight stormwater outfalls that are not associated with mining activities, and a single outfall (005) that discharges drainage from the Cottonwood tailings pile. Monitoring data from outfall BHP005 indicates that this relatively small discharge contains very low dissolved copper concentrations but high hardness concentrations (Table 1-2).

TABLE 1-2
Summary of Monitoring Data from BHP Outfall 005

Sampling Quarter	pH	Hardness, as CaCO ₃ (mg/l)	Total Cu (mg/l)	Flow (MGD)
3Q2000	7.61	1,300	<0.004	0.0086
1Q2001	7.51	1,400	<0.004	0.0086
2Q2001	7.09	1,300	<0.004	0.0086
3Q2001	7.53	1,300	<0.004	0.0128
4Q2001	7.88	1,300	<0.004	0.0086
1Q2002	7.53	1,400	<0.004	0.0086
2Q2002	6.88	1,400	<.02	0.0086
3Q2002	7.08	1,300	<.02	0.0086

In October 1997, tailings were spilled into Pinto Creek due to a partial failure of BHP impoundments 1 and 2. The debris was removed under a CERCLA action by July 1998, and BHP monitoring data indicates that the remediation successfully eliminated any additional copper loads as a result of the spill (USEPA, 2001).

Proposed Carlota Copper Project: The Carlota Copper Company (Carlota) has proposed the development of an open-pit mining operation of the Cactus Breccia between Pinto Creek and Powers Gulch. Proposed facilities located within these drainages include 3 open pits, 3 surface

INTRODUCTION 1

disposal areas, a heap-leach pad and associated process plant, and administrative facilities (Figure 1-5). Stockpiles would be constructed to the northwest and south of the Carlota/Cactus pit, and a 100 million ton capacity heap-leach pad will be located in Powers Gulch. The Powers Gulch drainage would be re-routed around the west side of the heap-leach pad facility. Carlota's proposed action also includes re-routing Pinto Creek around the east and north side of the Carlota/Cactus pit. This diversion and the mining of the Cactus Breccia would be expected to reduce the influence of this natural geologic copper source on Pinto Creek.

Studies of the potential environmental impacts of the project determined that groundwater withdrawals would cause a cone of depression resulting in decreased local water levels, flow to natural springs and surface flow and alluvial underflow to Haunted Canyon and Pinto Creek. A well field mitigation and monitoring program was designed to maintain stream flows in Haunted Canyon and Pinto Creek to pre-project levels.

In 1997 the U.S. Forest Service completed an environmental impact statement (EIS) and record of decision (ROD) that authorized the proposed action. The Carlota Copper Company subsequently applied for a NPDES permit to discharge stormwater associated with the Main Rock Area and Eder Rock Area. Engineering controls were proposed to prevent discharges from these area during storms small than the 10-year, 24-hour event. All other mining operations associated with the project were to be designed to prevent discharge during the 100-year, 24 hour storm event. However, in 2004, the Carlota Company proposed to ADEQ a redesign of the operations to prevent all stormwater discharges for storms up to and including the 100-year, 24-hour event.

1.4 SUMMARY OF PHASE I TMDL

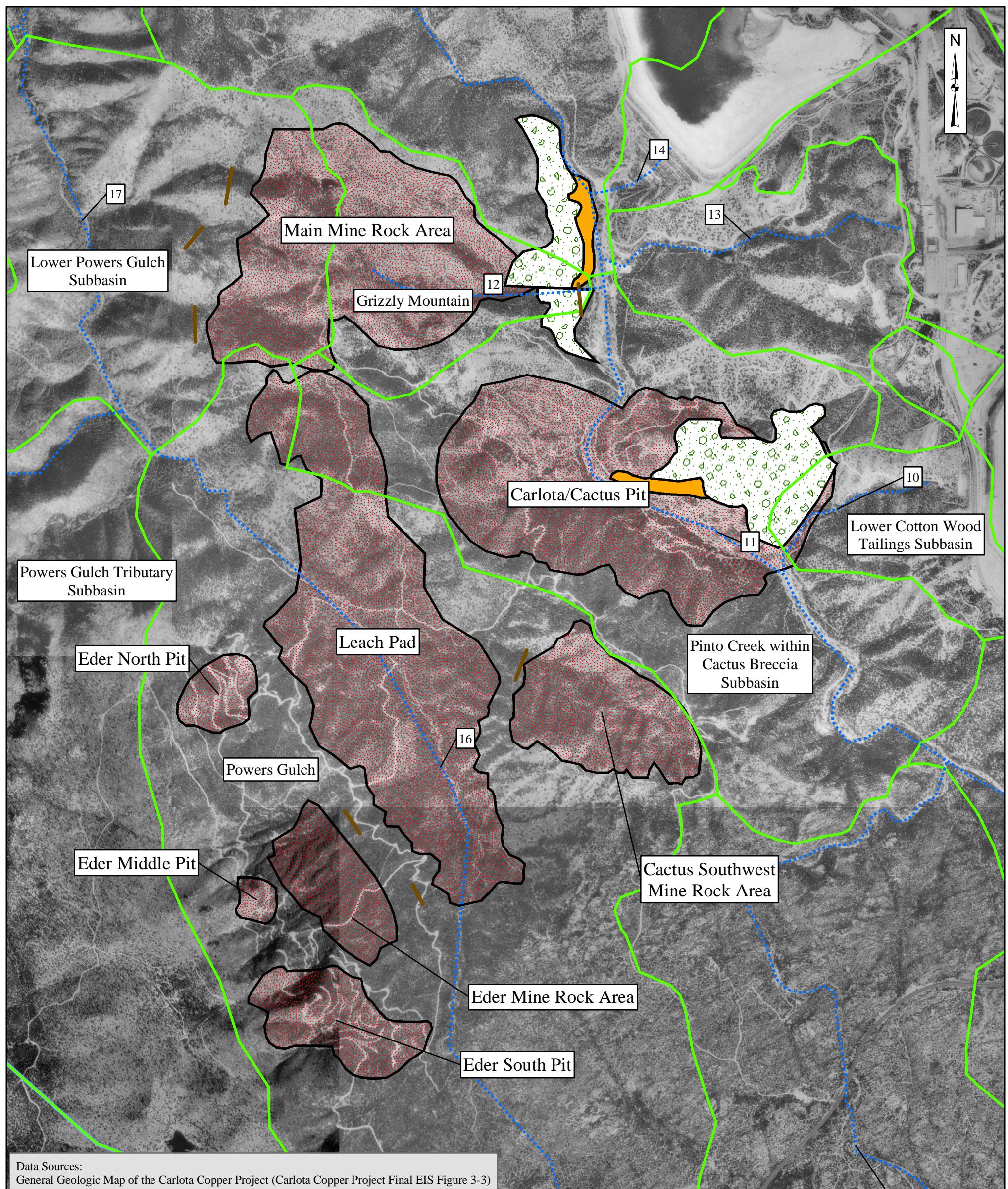
In April 2001, the USEPA Region 9 office completed a Phase I report describing the TMDL for dissolved copper in Pinto Creek, in response to the ADEQ's 303(d) listing of Pinto Creek. The Phase I report established target sites, loading capacities, background conditions, load allocations (LAs), wasteload allocations (WLAs), and a margin of safety in the TMDL calculations. For the Pinto Creek Phase I, USEPA used the wildlife and warm water aquatic life (A&Ww) water quality criterion for dissolved copper, assuming a hardness value of 400 mg/L.

USEPA identified 9 target sites for the allocation of loading capacity in the Pinto Creek watershed. These sites were largely based on the confluences of tributaries, but were also located based on potential copper loading sources (i.e. known and proposed facilities), background sources, and the locations of current monitoring points.

Because most of the streams in the Pinto Creek watershed are ephemeral and/or intermittent and because there were few available rainfall/runoff data for the Pinto Creek watershed, USEPA developed a HEC-1 (U.S. Army Corps of Engineers, Hydrologic Engineering Center) rainfall-runoff model to estimate the stream discharge at their nine target sites. Discharge was estimated at each target site for each of five precipitation events, or flow tiers. USEPA then used the estimated stream discharges at target sites to establish loading capacities (i.e. the TMDLs), background loads, load allocations (LAs), and Wasteload Allocations (WLAs).

The five flow tiers that were applied to each target site and were the basis for the loading capacities, background loads, LAs, and TMDLs were:

- 1) Less than the 2-year, 1-hour storm event;
- 2) 2-year, 1-hour storm to 10-year, 1-hour storm event;



Legend

- Proposed Carlota Diversions
- Pinto Creek and Tributaries
- Pinto Creek Watershed
- Subbasins
- Proposed Carlota Mine Areas

Geologic Units

- Cactus Breccia
- Whitetail Conglomerate

0 625 1,250 2,500 3,750
Feet

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**Proposed Carlota Copper
Project Facilities**

Figure 1-5

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- 3) 10-year, 1-hour storm to 10-year, 24-hour storm event;
- 4) 10-year, 24-hour storm to 100-year, 24-hour storm event;
- 5) Greater than the 100-year, 24-hour storm event.

Except for the first tier, which represents no discharge up to the 2-year, 1-hour storm event discharge, the loading capacities for each tier were set at the lower discharge value for the tier. For the first tier, the load allocations were set that each source met A&Ww-acute and A&Ww-chronic standards.

1.5 PURPOSE OF THE PHASE II TMDL

The Phase I TMDL made a great deal of progress in identifying the major sources of copper to Pinto Creek and estimating their relative contribution under different hydrologic conditions. The Phase I analysis was limited, however, by the availability of water quality, meteorologic, and streamflow data to characterize natural background concentrations, mining-related sources, and both geographic and hydrologic variability of copper and hardness loading patterns. The TMDL calculation approach was necessarily simplistic.

The Phase II TMDL was initiated to build upon the results of the Phase I TMDL, with the advantage of a great deal of water quality, meteorologic, and hydrologic data collected by ADEQ during 2000-2004. ADEQ's data collection was specifically designed to characterize background concentrations and copper loads from major sources, with the intent to supporting the calibration of a dynamic watershed-water quality model of dissolved copper in Pinto Creek. The resulting Phase II TMDL load allocations will be more accurate than the Phase I TMDL. Given the elevated background concentrations, the Phase II TMDL model was also expected to be useful for deriving site-specific dissolved copper criteria for Pinto Creek, if necessary.

DATA SOURCES

This section describes the sources of water quality, meteorologic, streamflow, and geographic data used to support the Phase II TMDL modeling for Pinto Creek.

2.1 WATER QUALITY DATA

The Phase I TMDL relied on a variety of water quality data from 26 monitoring points throughout the basin (USEPA, 2001), including data collected by BHP, the Carlota Copper Company, ADEQ, and the U.S. Forest Service. Especially useful were copper and hardness data that BHP has collected at 6 ambient monitoring program (AMP) since 1993 (Figure 2-1). A major limitation of the Phase I TMDL was that much of the water quality data available to USEPA were collected during low or unknown flow conditions, making it difficult to assess loads during storm events. Also, relatively little data were available to assess/quantify loads from specific mining-related sources or to characterize the background dissolved copper concentrations associated with different lithologies.

In 2000, ADEQ initiated a monitoring program to collect additional water quality, stream stage, and meteorological data in the Pinto Creek basin. Stage-triggered automatic samplers were placed at four stations (Gibson tributary, PC-100, PC-200, and PC-300) and water quality samples were collected at these locations under a range of stage conditions. ADEQ also sampled runoff at 44 other locations in the basin, representing a variety of sources and lithologies (Figure 2-1). Most samples were analyzed for dissolved copper, calcium, magnesium, sulfate, hardness, and field parameters such as pH and specific conductance. Selected samples were also analyzed for other constituents such as zinc, iron, selenium, total suspended solids, and total dissolved solids.

2.2 METEOROLOGICAL DATA

Historical meteorological data were available from a Remote Automated Weather Station (RAWS) in Globe, approximately 20 miles from Pinto Creek. The Western Regional Climatic Center provided hourly precipitation, wind speed, temperature, relative humidity, and solar radiation data from this site. These data spanned March 1990 to March 2004, but no data were available between November 1995 and December 2001. BHP also operates a rain gage that has produced daily precipitation data since 1989.

To support the Phase II TMDL modeling, ADEQ also desired meteorological data from within the Pinto Creek watershed that was collected at a more frequent interval, and installed rain gages to collect 15-minute data at three locations (Figure 2-1):

- ♣ PC-100 (operational in October 2000)
- ♣ Pinto Creek-Mineral Creek Divide (operational in March 2001)
- ♣ West Fork of Pinto Creek (operational in October 2001)

In September 2002, ADEQ also installed a meteorological station at the Pinto Creek-Mineral Creek divide station to collect temperature, wind speed, relative humidity, and solar radiation data at 15-minute intervals.



Legend

● ADEQ Sample Locations

△ USGS Gaging Stations

○ BHP Sample Locations

◆ Weather Stations

— 303(d)-listed segment

- - - Pinto Creek and Tributaries

■ Pinto Creek Watershed

0 1 2 4 6

Miles

Notes:

(+) = locations where precipitation data was collected

(*) = locations where stage and cross section were collected, and discharge was calculated

(◆) = locations where water quality autosampler data was collected

(#) = location used to collect precipitation, air temperature, relative humidity, solar radiation and wind speed data.

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Monitoring Locations

Figure 2-1

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DATA SOURCES 2

2.3 STREAMFLOW DATA

The U.S. Geological Survey operates two stream gages in Pinto Creek (Figure 2-1). Station 09498501 (Pinto Creek below Haunted Canyon) has been operational since 1995, and station 09498502 (Pinto Creek near Miami, also known as the Pinto Valley Weir site) has been operational since 1994. The Arizona District of the USGS provided 15-minute streamflow data from these stations for their entire period of record up through March 2004.

To support the Phase II TMDL modeling, ADEQ also desired additional streamflow data in the upper reaches of the Pinto Creek basin, at locations that would help quantify the loads from mining related sources such as the Gibson mine. ADEQ installed data recorders to collect 15-minute stage data at three locations (Figure 2-1):

- ♣ Pinto Creek above the Gibson tributary (operational January 2001)
- ♣ Gibson tributary (operational January 2001)
- ♣ PC-100 (operational October 2001)

To estimate streamflow from these stage data, it was necessary to estimate stage discharge relations from channel cross-section data collected by ADEQ. WinXSPRO, a program that is specifically designed for estimating stage-discharge relations in high-gradient streams using the Manning formula (West Consultants, 1998). The slope of the water surface was estimated and assumed to be the same as the slope of the channel bottom, as calculated from ADEQ channel survey data and topographic maps. The Manning's n coefficients were then adjusted to obtain reasonable matches between predicted and measured stage and discharge measurements. WinXSPRO estimated a best-fit quadratic equation for the stage discharge relations at the three gaging stations. This equation was used to estimate discharge from stage records in 15-minute increments. The rating curves generated by the WinXSPRO model are included in Appendix D.

TABLE 2-1
Sources of Time-Dependent Data in the Pinto Creek Basin

Type of Data	Source	Time Span	Notes
Water Quality	ADEQ	August 2000—Mar 2004	Variety of locations
	BHP	Jul 1993—Apr 2003	Quarterly monitoring at 6 AMP stations
Meteorological	ADEQ	Oct 2000—Mar 2004	15-minute data; 3 locations
	RAWS	Mar 1990—Oct 1995; Dec 2001—Mar 2004	Hourly data; station in Globe
	BHP	Jan 1974—Sep 2003	Daily precipitation only
Streamflow	USGS	Oct 1994—Mar 2004	Pinto Creek at Pinto Valley Weir
		Oct 1995—Mar 2004	Pinto Creek below Haunted Canyon
	ADEQ	2001-2003	Spot measurements at staging locations and grab sample locations
Stream Stage	ADEQ	Oct 2001—Mar 2004	Three locations: above Gibson, Gibson, PC-100.
Point Source Inputs	BHP	2000—2002	Discharge monitoring reports

2.4 GEOGRAPHIC DATA

Geographic data that were available for the Pinto Creek region included 1:24,000 30-m resolution digital elevation models (DEMs), digital orthophoto quarter quadrangles (DOQQs), and various public domain maps and coverages for soils, land cover, geology, and hydrography

DATA SOURCES 2

(2-2). Additional information on land cover, hydrology, and geology were obtained from site visits, the USFS Final Environmental Impact Statement for the Carlota Copper Project and consultation with ADEQ personnel.

TABLE 2-2
Sources of Geographic/Physical Data in the Pinto Creek Basin

Type of Data	Source	Scale	Digital?
Hydrography	USGS—National Hydrography Dataset	1:100,000	Yes
Geology	ALRIS statewide geology (Arizona Geological Survey and U.S. Bureau of Land Management)	1:1,000,000	Yes
	Arizona Bureau of Mines county-level geologic maps	1:375,000	No
	USFS—EIS for Carlota Copper Project	1:24,000	No
Topography	Digital raster graphics	1:24,000 1:100,000 1:250,000	Yes
	USGS—Digital elevation models	1:24,000	Yes
	USGS—DOQQs	1:24,000	Yes
Land use/land cover	USGS—Land use/land cover	1:250,000	
Soils	USDA—STATSGO	1:250,000	Yes
Vegetative cover	ALRIS—Natural Vegetation	1:1,000,000	Yes
Drainage diversions	BHP: SWP3 map	—	Yes
Proposed Carlota Copper Project operation areas and drainage diversions	USFS—EIS for Carlota Copper Project	—	No
Mines	ALRIS—U.S. Bureau of Mines USFS Abandoned and Inactive Mines (AIMS) database	—	Yes
Stream cross sections	ADEQ (3 stream staging locations)	—	Yes

CONCEPTUAL MODEL

Most of the stream length above the Cactus Breccia is ephemeral or intermittent in nature, flowing typically in response to storm events or snowmelt. However, the middle portion of the creek contains several reaches that flow most of all the year. For example, PC-200 flows during most of the winter and spring, and perennial flows occur at PC-300. The perennial reaches occur where thin alluvium and bedrock constrictions force groundwater to the surface. Hydrogeologic studies performed by the Carlota Copper Company indicate that most of the baseflow is derived from the alluvium itself and not the regional bedrock aquifer system (Groundwater Resources Consultants, Inc., 1994).

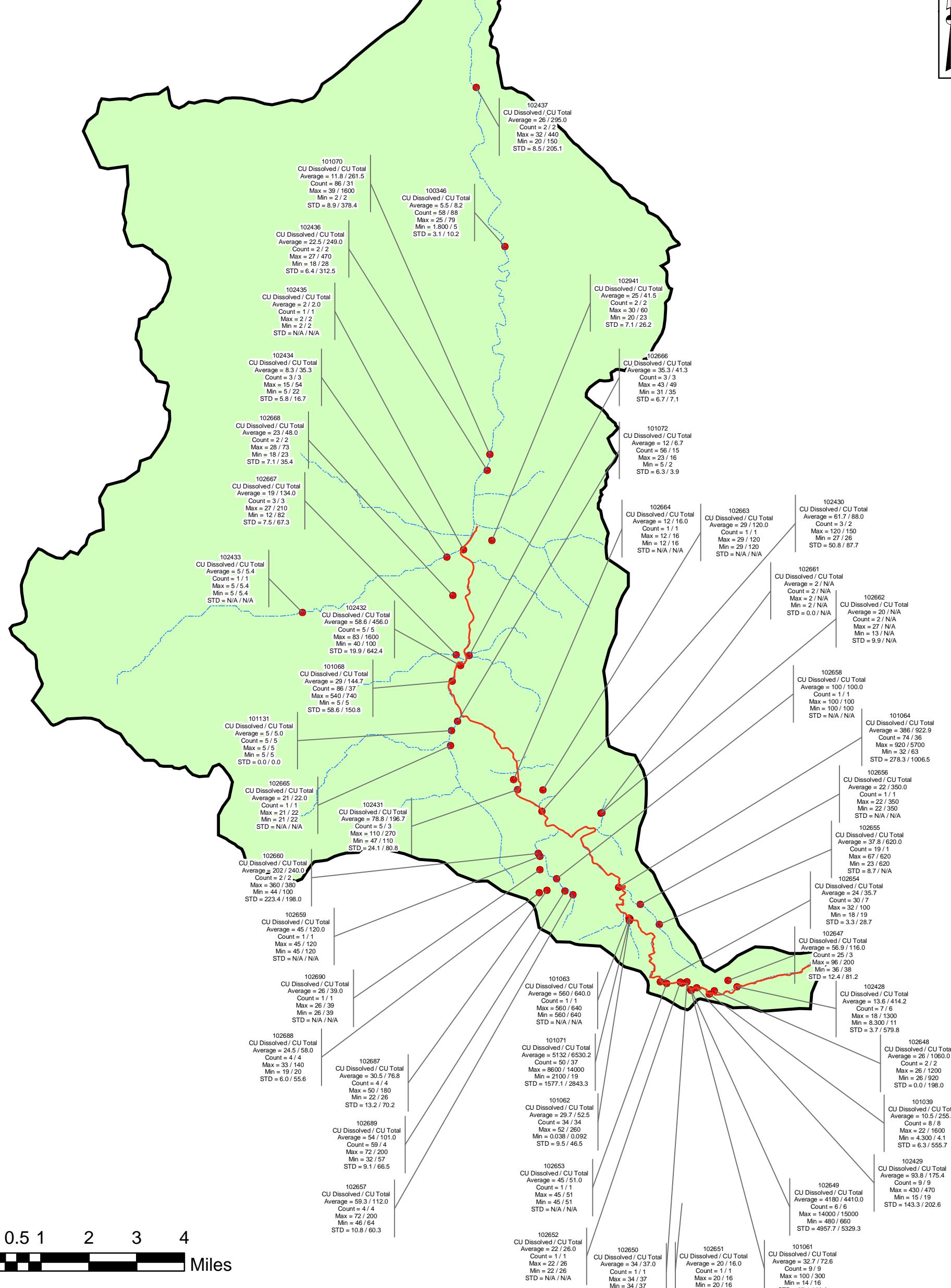
An evaluation of monitoring data collected by ADEQ, BHP, and other agencies reveals the general pattern of dissolved copper concentrations and loading in Pinto Creek. Dissolved copper concentrations are detectable (4- 26 µg/L) even in the upper headwaters near Simpson Dam, above Henderson Ranch mines (Figure 3-1), probably derived from natural sources and possibly the Ellis mine. The average dissolved copper concentration increases to over 100 µg/L near the Henderson Ranch Mines. Dilution and in-stream losses bring the average dissolved copper concentration down to about 30 µg/L above the Gibson tributary. Flows from the Gibson tributary itself have the highest dissolved copper concentrations observed in the Pinto Creek basin, averaging over 5,000 µg/L, derived from the Gibson mine. Monitoring data at PC-100 reflects the high loads from the Gibson tributary, with an average dissolved copper concentration of almost 400 µg/L.

Dilution and in-stream losses cause a significant reduction in dissolved copper concentrations between PC-100 and Pinto Creek above the Cactus Breccia. Data from BHP monitoring station AMP-1 (mostly collected during relatively low flow conditions) and ADEQ stations PC-ACB reveal average dissolved copper concentrations in the 10-60 µg/L range, with the lower concentrations occurring during lower flow periods. BHP and ADEQ monitoring data reveal an increase in dissolved copper concentrations to the 40-80 µg/L below the Cactus Breccia, and concentrations commonly exceed 100 µg/L at this location. Most of this increase is derived from the Cactus Breccia itself as Pinto Creek flows over this formation. Dissolved copper concentrations continue to decrease by dilution and instream losses between the Cactus Breccia and PC-200 below Haunted Canyon, and between PC-200 and PC-300 at the Pinto Valley Weir.

Storm flows represents the critical hydrologic conditions for copper in Pinto Creek, due to high loads derived from runoff from the Gibson mine and other mining related sources. Many smaller storms in the headwaters do not cause storm peaks at PC-200 or PC-300, because the stormflows infiltrate into the Pinto Creek alluvium upstream of these stations. However, a portion of the infiltrated water eventually re-emerges as baseflow at PC-200 and PC-300. Thus, copper loads from surface runoff in the upper basin can affect low flow concentrations in the middle basin.

3.1 BACKGROUND DISSOLVED COPPER CONCENTRATIONS

As part of the 2000-2004 monitoring program, ADEQ collected water quality samples that were representative of runoff from relatively undisturbed portions of the Pinto Creek watershed, some of which represent a single lithology. The mean dissolved copper concentrations observed at



Legend

- Pinto Creek and Tributaries
- 303(d) Listed Segment
- ADEQ Sample Locations and Copper Values in ug/L
- Pinto Creek Watershed

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Mean Copper Concentrations
at ADEQ Monitoring Locations

Figure 3-1

February 2006

CONCEPTUAL MODEL 3

these locations were used to characterize the background concentrations in the basin, as summarized in Table 3-1.

TABLE 3-1

Background Concentrations of Dissolved Copper and Zinc from Different Land Covers in the Pinto Creek Basin

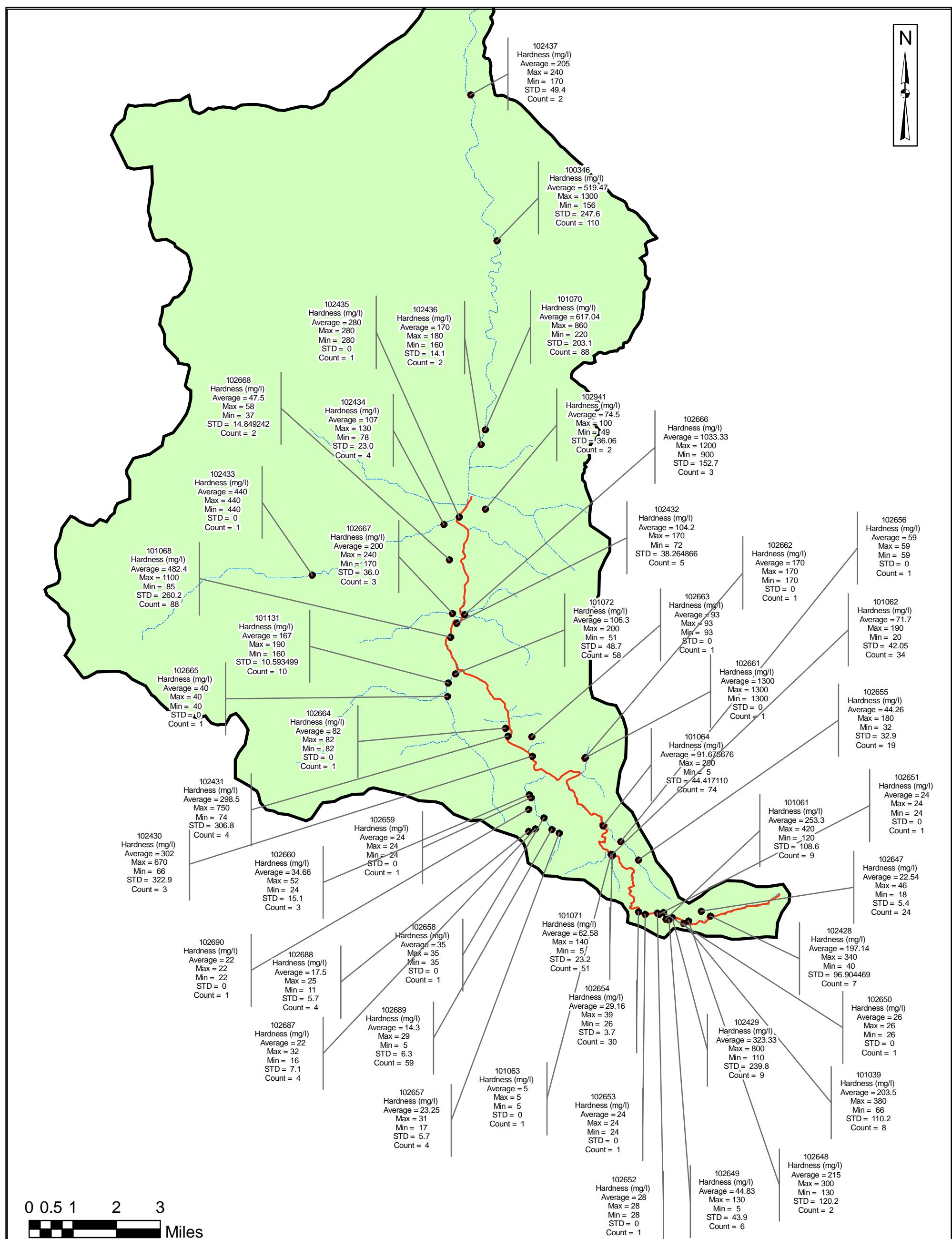
[from ADEQ monitoring data 2000-2004]

Lithology	Representative Sample Locations (see Fig. 2-1)	Average Dissolved Copper Concentration (µg/L)
Schultz Granite	PC-SG, PC-TS1, PC-60W1, PC-60W2	39.5
Schist	PC-FR2, PC-349BMF, PC-349AHR, 102647	32.2
Dacite	PC-PG, PC-TAWF	25
Alluvium	PC-TARS, 102941, 102868	24
Mixed; West Fork Pinto Creek	WPC-BKR	7.5
Mixed; Haunted Canyon	PC-HC, 101072, 101131	7.9
Mixed; Powers Gulch	102665	21
Mixed; Above Henderson Ranch Mines	102428, 101039	12
Mixed; Mowing Machine Basin	102667	19
Mixed; Pinto Creek Below PC-300	101070, 100346	7.5

3.2 HARDNESS

Because the dissolved copper criteria are hardness-based, knowledge of the geographic and hydrologic patterns in hardness is important to assessing compliance with water quality standards. Monitoring data reveal that hardness was moderate (average concentration = 200 mg/L as CaCO₃) in the headwaters above Henderson Ranch Mines, but lower (<100 mg/L) at PC-100 and most other locations upstream from PC-100, including the Gibson tributary (Figure 3-2). Hardness generally increased downstream from PC-100.

In the vicinity of the Cactus Breccia and PC-200, BHP and ADEQ monitoring data reveal that hardness is higher under low flow conditions than stormflow conditions. For example, hardness at PC-200 usually exceeded 400 mg/L when streamflow was less than 10 cfs, but averaged about 150 mg/L when streamflow exceeded 10 cfs (Figure 3-3). Hardness continued to increase downstream between PC-200 and PC-300; the average hardness exceeded 400 mg/L at PC-300 even under higher flow conditions. The downstream increase in hardness can be attributed to both geologic sources (e.g., carbonate rocks in the Apache Group) and contributions from mining operations such as discharge from BHP outfall 005. Groundwater contributions that have infiltrated through hardness-rich stockpiles might also be a factor under low flow conditions.



CONCEPTUAL MODEL 3

Table 3-2 lists the values of hardness that were used for the purposes of assessing compliance with the copper criterion at different locations.

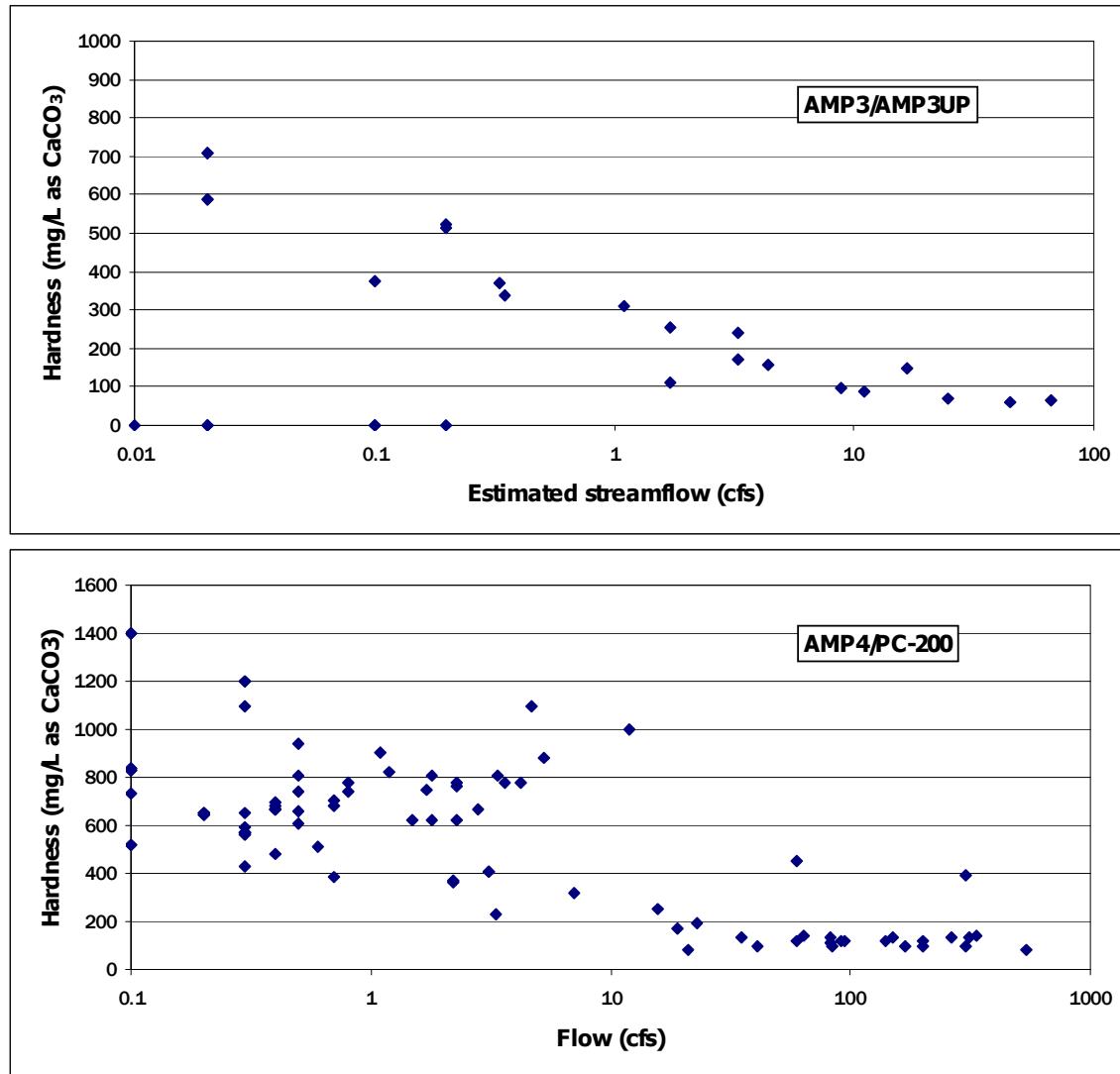


Figure 3-3: Hardness-flow relations at stations AMP3/AMPUP and ADEQ station PC-200, based on 1993-2002 monitoring data.

CONCEPTUAL MODEL 3

TABLE 3-2
Average Hardness Values Used for Criterion Calculation

Location	Average Hardness (mg/L as CaCO₃)	Acute Dissolved Copper Criterion (µg/L)	Chronic Dissolved Copper Criterion (µg/L)
1. Pinto Cr above Henderson Ranch Mines	200	25.8	16.2
2. Pinto Cr below Henderson Ranch Mines	70	9.6	6.6
3. Gibson Tributary	64	8.8	6.1
4. PC-100	90	12.2	8.2
5. Five Point Mountain Tributary	29	4.2	3.1
6. Pinto Cr Below Cactus Breccia	299	37.7	22.8
7. Haunted Canyon	170	22.2	14.1
8. PC-200	150 (high flow) 680 (low flow) ^a	19.7 49.6	12.7 29.3
9. PC-300	630 ^a	49.6	29.3
10. Basin exit	205	26.4	16.6

^a400 mg/L is the maximum hardness value that can be used for adjustment under Arizona's water quality standards.

MODEL CODE SELECTION

A dynamic model with a relatively short time-step (hourly or less) was necessary to simulate the flashy nature of Pinto Creek's flow and copper loading. The model was needed to simulate the different hydrologic characteristics and metals loading associated with different land covers and lithologies, as well as instream transport processes. It was preferred that the model have a GIS-interface to facilitate model development and application. It was also desired that the chosen model should be understood and accepted by regulatory agencies such as ADEQ and USEPA.

Four major different types of processes need to be simulated in Pinto Creek: (1) hydrologic fluxes to the stream; (2) copper loads to the stream; (3) stream hydraulics; and (4) in-stream pollutant transport. During the model selection step, it was acknowledged that several different modeling systems (e.g., HSPF, SWMM) or a combination of models (e.g., HEC-1 to simulated hydrology, WASP6 to simulate in-stream transport) would serve the project objectives. Although several software systems would be adequate for the purposes of this project, the Hydrologic Simulation Program-Fortran (HSPF) version 12 was selected for the following reasons:

1. HSPF is capable of simulating a wide range of hydrologic and pollutant transport processes that would need to be considered in Pinto Creek, including in-stream losses of copper.
2. Using the USEPA software BASINS 3.0, the HSPF model could be developed with the aid of a powerful GIS interface. BASINS 3.0 also includes pre- and post-processing software (WDMUtil and GENSCN) and a Windows-based program for executing HSPF (WinHSPF).
3. BASINS/HSPF is well-accepted by USEPA for TMDL development.

The primary disadvantages of HSPF are the relative complexity of its algorithms and intensive data requirements. However, it was judged that the available hydrologic and water quality data were sufficient for the development and calibration of the HSPF model that would simulate most of the hydrologic/geographic variability in metals loading to the stream.

MODEL DESIGN

The Pinto Creek model was developed in the BASINS 3.0 - WinHSPF framework. This process consisted of first developing GIS coverages of the stream reaches, subbasins, and land uses, and then using this information to create the base input files to WinHSPF. Parameter estimation, sensitivity analysis, and calibration were then carried out using WDMUtil to process the input meteorological data sets, WinHSPF to execute the model, and GENSCN to examine model results. The HSPF modules that were employed are summarized in Table 5-1.

TABLE 5-1
Summary of HSPF Modules Used in the Pinto Creek Model

HSPF Module	Section	Process
PERLND	ATEMP	Temperature adjustment for elevation
	SNOW	Snow/ice accumulation and melting
	PWATER	Pervious land hydrology
	SEDMNT	Detachment and washoff of sediment
	PQUAL	Loading of copper
RCHRES	HYDR	In-stream hydraulics
	ADCALC	Prepare to simulate advective transport
	GQUAL	In-stream transport of dissolved copper

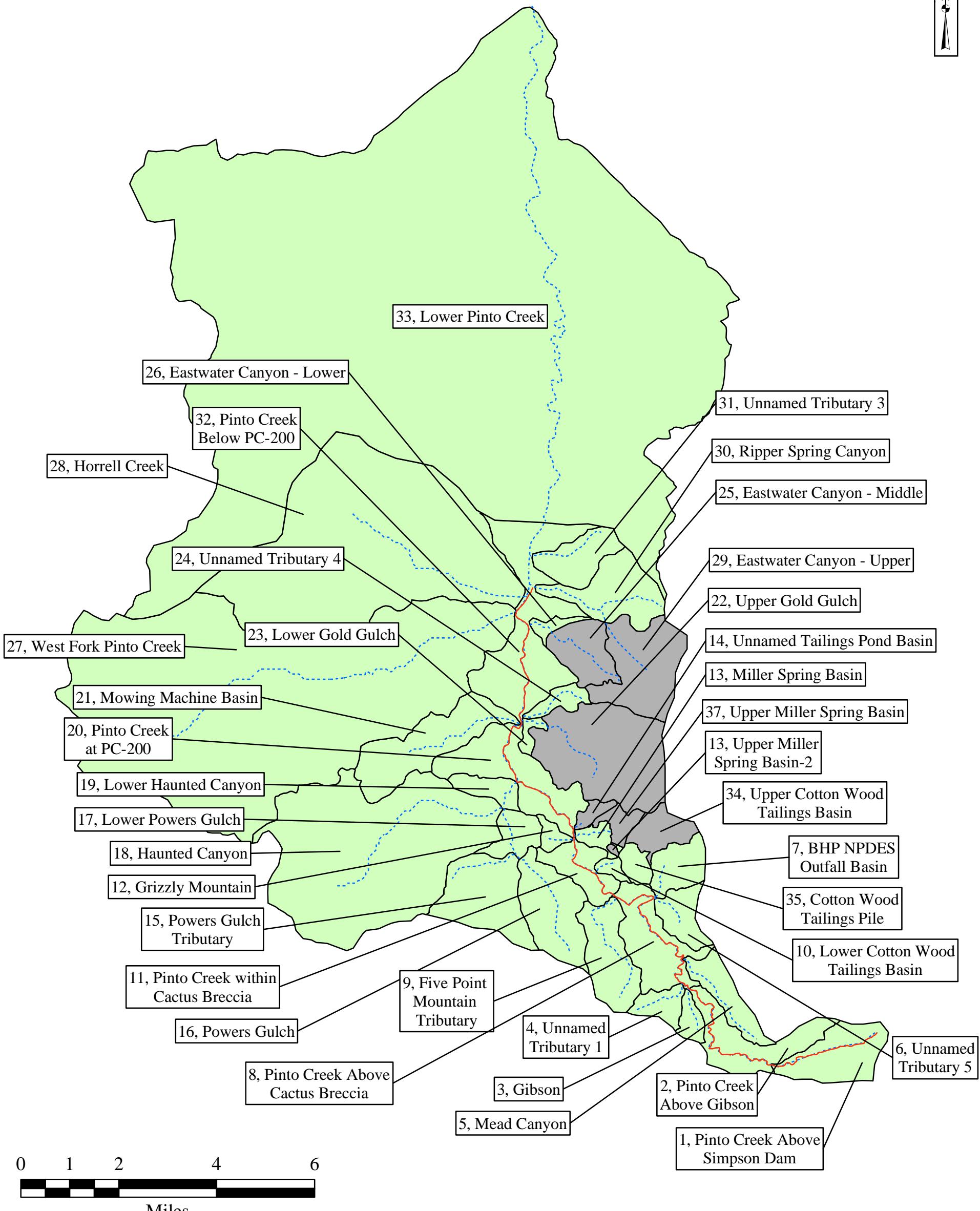
5.1 MODEL SEGMENTATION

In HSPF, a watershed is conceptually divided into pervious land segments (PERLNDs), or impervious land segments (IMPLNDs) on the basis of similar hydrologic and pollutant loading characteristics. Similarly, a stream network is segmented into stream reaches (RCHRESES) of similar hydraulic characteristics that receive flow and pollutant loads from land segments. For the Pinto Creek model, it was determined that there was insufficient developed/impervious land in the basin to merit use of the IMPLND module; only the PERLND and RCHRES modules were applied.

The conceptual segmentation of the Pinto Creek model into pervious land segments was accomplished first dividing the watershed into 41 subbasins (Figure 5-1), and assigning a unique segment number to each of the following nine geology/land cover types (Figure 1-3) within each subbasin:

1. Granite
2. Schist
3. Tailings
4. Alluvium
5. Basalt
6. Cactus Breccia
7. Dacite
8. Diabase
9. Apache Group

TABLE 5-2



Legend

- Pinto Creek Subbasins that are not diverted (Light Green)
- Pinto Creek Subbasins that are presently diverted (Dark Grey)
- 303(d)-listed segment (Red wavy line)
- Pinto Creek and Tributaries (Blue dashed line)

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4646 E. Van Buren St.
Phoenix, AZ 85008

**Subbasins and Reaches of
the Pinto Creek HSPF Model**

Figure 5-1

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Subbasins and Reaches of the Pinto Creek Model

[See Figure 5-1 for locations of subbasins and reaches]

<i>Subbasin/ Reach</i>	<i>Name</i>
1	<i>Pinto Creek</i>
2	<i>Pinto Creek</i>
3	<i>Gibson</i>
4	<i>Unnamed Tributary</i>
5	<i>Mead Canyon</i>
6	<i>Unnamed Tributary</i>
7	<i>BHP Outfall 005</i>
8	<i>Pinto Creek</i>
9	<i>Unnamed Tributary #2</i>
10	<i>Lower Cottonwood Tailings</i>
11	<i>Pinto Creek(Below Cactus Breccia)</i>
12	<i>Grizzly Mountain</i>
13	<i>Miller Spring</i>
14	<i>Unnamed Tributary</i>
15	<i>Unnamed Tributary</i>
16	<i>Powers Gulch</i>
17	<i>Lower Powers Gulch</i>
18	<i>Haunted Canyon</i>
19	<i>Lower Haunted Canyon</i>
20	<i>Pinto Creek</i>
21	<i>Mowing Machine Basin</i>

<i>Subbasin/ Reach</i>	<i>Name</i>
22	<i>Upper Gold Gulch</i>
23	<i>Lower Gold Gulch</i>
24	<i>Unnamed Tributary</i>
25	<i>Middle Eastwater Canyon</i>
26	<i>Lower Eastwater Canyon</i>
27	<i>West Fork Pinto Creek</i>
28	<i>Horrell Creek</i>
29	<i>Upper Eastwater Canyon</i>
30	<i>Lower Ripper Springs</i>
31	<i>Unnamed Tributary</i>
32	<i>Pinto Creek</i>
33	<i>Pinto Creek</i>
34	<i>Upper Cottonwood Tailings</i>
35	<i>Cottonwood Tailings Pile</i>
36	<i>Upper Miller Springs-1</i>
37	<i>Upper Miller Springs-2</i>
38	<i>Out of Basin</i>
39	<i>Carlota Main Rock Area</i>
40	<i>Carlota Main Rock Area</i>
41	<i>Carlota Eder Rock Area</i>

The PERLND segments were numbered by subbasin (first one or two digits) and cover type as enumerated above (last digit). For example, PERLND 11 represents the area underlain by granite in subbasin 1, and PERLND 127 represents the area underlain by dacite in subbasin 12. Appendix A lists the land segments and stream reaches by number, geology/cover type, and acreage. Certain mine-related sources were assigned PERLNDs of nominal acreage (5 acres, except for the Gibson Mine, which was 15.1 acres) to allow empirical calibration of the copper loads from those sources. These segments include:

- ♣ PERLND 13—Ellis Mine
- ♣ PERLND 23—Henderson Ranch Mines
- ♣ PERLND 33—Gibson Mine
- ♣ PERLND 93—Bronx Mine
- ♣ PERLND 97—Old Highway 60 Mine
- ♣ PERLND 113—Yo Tambien Tunnel

Similarly, proposed Carlota facilities were treated as pervious land segments for those model scenarios that involved discharge from the Main Rock Area and Eder Rock Area:

- ♣ PERLND 119—Main Rock Area (west)
- ♣ PERLND 123—Main Rock Area (east)
- ♣ PERLND 163—Eder Rock Area

- ♣ PERLND 173—Main Rock Area (west)

For HSPF modeling purposes, Pinto Creek and its major tributaries were also subdivided into 41 reaches of similar characteristics (Table 5-2; Figure 5-1). An additional, a hypothetical stream reach (RCHRES 38) was created in the model to represent the target of any drainage with the Pinto Creek watershed that is diverted away from the Pinto Creek channel.

Carlota Copper Facilities: Three additional RCHRES segments were included to represent stormwater detention ponds that would receive stormwater runoff from the Main Rock Area and Eder Rock Areas of the proposed Carlota Copper Project. These segments include:

- ♣ RCHRES 39—Represents four ponds proposed to receive runoff from the west side of the Main Rock Area (PERLNDs 119, 173) and discharge to RCHRES 17 (Lower Powers Gulch). According to the 1997 EIS, these ponds would only discharge during storms greater than the 10-year, 24-hour event.
- ♣ RCHRES 40—Represents one pond proposed to receive runoff from the east side of the Main Rock Area (PERLND 123) and discharge to RCHRES 12 (Grizzly Mountain tributary of Pinto Creek). According to the 1997 EIS, this pond would only discharge during storms greater than the 100-year, 24-hour event.
- ♣ RCHRES 41—Represents three ponds proposed to receive runoff from the Eder Rock Area (PERLND 163) and discharge to RCHRES 16 (Powers Gulch). According to the 1997 EIS, these ponds would only discharge during storms greater than the 10-year, 24-hour event.

5.2 HYDROLOGIC SIMULATION

The PWATER and SNOW subroutines of the PERLND module were used to simulate the hydrologic processes on each land segment. A fifteen-minute model time step was selected to consider the flashy nature of storms and runoff in the Pinto Creek basin. The model calibration period was chosen as December 17, 2001 to March 29, 2004 based on the availability of meteorological input data sets (discussed below) and streamflow/water quality data for calibration (discussed in section 5).

Meteorological Data: Within the SNOW subroutines, the degree-day method was used to simulate accumulation and melting of snow and ice. The required input data for these routines included precipitation, air temperature, and potential evapotranspiration. Precipitation data in 15-minute increments were available from the three ADEQ gages at PC-100, West Fork of Pinto Creek, and the Pinto Creek-Mineral Creek divide station. Within the model simulation period, “missing” periods of precipitation data for each station were filled in with data from the nearest station. The supplemented data sets were then used as input data for proximal pervious land segments and stream reaches.

Air temperature data from the ADEQ Pinto Creek-Mineral Creek divide gage were used as input to all model segments. Potential evapotranspiration for all segments was calculated as a function of solar radiation, air temperature, relative humidity, and wind speed data from the ADEQ Pinto Creek-Mineral Creek gage using the Penman-Monteith equation as described by Shuttleworth (1992). Because the ADEQ Pinto Creek-Mineral Creek was not operational until September 2002, the air temperature time series were supplemented with hourly data collected at the Globe

RAWS stations between December 2001 and September 2002. Similarly, data from the Globe RAWS station were used to estimate hourly potential evapotranspiration for this time period. The ATEMP submodule was used to adjust air temperature values based on differences in elevation between land segments and the meteorological stations.

5.3 COPPER LOADING

The PQUAL subroutine of the PERLND module was used to simulate the washoff of copper from pervious land segments, as well as to specify concentrations of those constituents in interflow and baseflow. PQUAL offers two methods for simulating the washoff of a quality constituent: (1) by accumulation-washoff (QUALOF); or (2) by association with sediment erosion and washoff (QUALSD). Neither of these methods was specifically designed for the simulation of dissolved metals in runoff, which do not necessarily over time nor are directly attached to sediment. However, the QUALSD routine can be used to model constituents that are highly correlated with precipitation and runoff, even if they are not actually attached to sediment, and so this routine was selected for the Pinto Creek model. The parameters of the HSPF sediment transport module were adjusted to allow simulation of a constant event mean concentration of dissolved copper from each pervious land segment.

Copper loads from the BHP outfall 005 were input as a point source to stream reach 7. Discharge monitoring reports were compiled and reviewed to characterize quarterly effluent flow and quarterly copper loads (Table 1-2) from this source. Based on this record, the BHP discharge was modeled as constant flow of 0.0086 MGD and a dissolved copper concentration of one-half the median detection limit (2 µg/L).

Carlota Copper Facilities: Certain model scenarios were developed to represent implementation of the Carlota Copper Project as described by the 1997 EIS (U.S. Forest Service, 1997), as described further in section 7. For these scenarios, copper concentration in runoff from the Main and Eder Rock Areas were set as 35 and 26 µg/L, respectively, based on the maximum concentrations as summarized by USEPA (2001). Other model scenarios were developed to represent implementation of the Carlota Copper Project with no discharge during storm events up to and including the 100-year, 24-hour event. Under both types of scenarios, loadings from the Cactus Breccia formation were reduced to the same level as surrounding lithologies, to account for the Pinto Creek channel diversion and mining of the Cactus Breccia formation.

5.4 OPEN CHANNEL HYDRAULICS

The HYDR subroutine was used to simulate flow in stream reaches. HSPF requires the user to develop tables called F-TABLES that represents the relations between water depth, area, volume, and discharge in each reach. The F-TABLES were developed by generalization of the stream cross-sectional information stage-discharge relations that were estimated to estimate streamflow at ADEQ monitoring stations (see section 2.3), supplemented by stream cross-section and slope information derived from topographic maps and ADEQ channel survey data.

A second exit was also added to certain reaches of the Pinto Creek channel (reaches 8, 11, 20, and 32) to allow the consideration of losses to groundwater in the alluvium. As discussed in section 6, the model was primarily calibrated to low-frequency event conditions where groundwater losses represent a negligible portion of the total load, and so the groundwater exits were not used directly in the hydraulic modeling. However, the additional groundwater exits might provide useful for future applications of the model.

Carlota Copper Facilities: The F-TABLES for the three RCHRES segment that represent Carlota retention ponds (see section 5.1) were developed in an iterative fashion to (1) ensure that the simulated discharge was zero for storm events up to and including the 10-year, 24-hour event (or the 100-year, 24-hour event for RCHRES 40); and (2) match the total discharge volumes associated with a storm event equal to the 110-percent of the 10-year, 24-hour storm event, summarized by USEPA (2001) as an average discharge of 2.4 cfs for a period of two hours at each of the six ponds that would discharge under this event.

5.5 IN-STREAM COPPER TRANSPORT

Water quality monitoring data from Pinto Creek provided strong evidence of in-stream losses of copper load, such as reaches in which the dissolved copper concentration decreased downstream more rapidly than would be expected from dilution and dispersion alone. The primary loss mechanisms of dissolved copper in streams are precipitation/settling, adsorption to suspended sediment that settles, direct adsorption to stream bottom sediments, and infiltration into the alluvial aquifer system. Because of the possibility of in-stream losses, dissolved copper was not modeled as a conservative constituent in Pinto Creek. Instead, HSPF's GQUAL routine was employed to simulate the advective transport of dissolved copper in the Pinto Creek channel.

The GQUAL routine allows several options for simulating in-stream losses of a constituent, including first-order decay, settling, adsorption, and even biological decay. After exploration of several methods, in-stream dissolved copper losses in Pinto Creek were empirically modeled by reducing the downstream loading of copper between reaches to match observed monitoring data.

PARAMETER ESTIMATION AND CALIBRATION

The HSPF modules used for Pinto Creek utilize over 50 different physical, hydrologic, and water quality parameters. Many of these could be estimated from knowledge of the physical and hydrologic characteristics of the watershed. Key calibration parameters were those that: (1) could not be reliably estimated simply from knowledge of watershed characteristics; and (2) would significantly change model results even when changed only by a small amount (i.e., parameters to which the model is “sensitive”). Key calibration parameters were identified and adjusted to optimize matches between model predictions, observed streamflow, and observed water quality data.

6.1 INITIAL PARAMETER ESTIMATION

Initial values of HSPF parameters values were estimated based on watershed characteristics with the aid of *BASINS Technical Note 6—Estimating Hydrology and Hydraulic Parameters for HSPF* (USEPA, 2000) and a compilation of HSPF parameters (HSPFParm) used in other modeling projects. Appendix B provides a summary of the initial values selection for HSPF hydrologic and water quality parameters, as well as comments on the basis for the selection. Following are additional comments on the basis for the selection of specific parameters:

PWATER: PWATER parameters were selected to characterize most soils in the Pinto Creek basins as Type C and D soils with moderate to low infiltration rates (INFILT), based on STATSGO soil survey information. Values of the slope of the land surface (SLSUR) and the average length of the overland flow plan (LSUR) in PWATER and IWATER were estimated for each subbasin from the digital elevation model (DEM) and topographic maps. The fraction of the land surface covered by winter-transpiring vegetation (FOREST) was set to 0.3 for undeveloped land and 0 for stockpiles. The index to lower zone evapotranspiration (LZETP) was set to the relatively low value of 0.2 for undisturbed lands, as representative of sparse vegetation. Most other PWATER parameters were selected either as the default value for ‘insensitive’ parameters or to characterize high-slope, arid, moderately vegetated conditions.

SNOW: Most SNOW parameters were set to default or ‘typical’ values according *BASINS Technical Note 6*. The maximum snow pack depth at which the entire segment is covered with snow (COVIND) was set to 4 inches (water equivalent) based on the mountainous topography. Little information existed for the degree-day factor (KVARY); it was set to 0.0011 after a previous model application by Cornell University (see <http://www.cfe.cornell.edu/wri/projects/pesticides/Canajoharie/fr/canafinal0.html>.)

HYDR: Stream reach length (LEN) change in elevation (DELTH) were taken directly from the stream reach coverage. Flags were selected to compute outflow as a function of reach volume as specified by the F-TABLEs.

PQUAL/SED: The parameters for sediment erosion and washoff were set to values that would allow modeling of a constant event mean concentration for a water quality parameter; in this case, copper. Similarly, copper concentrations in interflow and baseflow were initially set as constant background concentrations based on monitoring data. The initial concentrations chosen for each land type were based on the “background” values for each land cover type, as listed in

table 3-1. These values were adjusted during the water quality calibration process. Final copper concentrations simulated for each land segment are tabulated in Appendix B (Table B-2).

6.2 HYDROLOGIC SENSITIVITY AND CALIBRATION

Experience with HSPF has shown hydrologic simulations to be moderately to highly sensitive to a number of parameters that are difficult to measure directly (Table 6-1). All of these parameters are used to dynamically partition moisture between different storages (e.g., surface storage), routings (e.g., interflow), and losses (e.g., evapotranspiration). The hydrologic calibration of HSPF was accomplished by adjusting hydrologic parameters to match to the average storm peak height and recession rates predicted by the stage-based method, as judged by graphical and statistical comparison. The PWATER parameters that were adjusted to achieve hydrologic calibration are listed in Table 6-1. No SNOW parameters were adjusted because no snow accumulation data existed for calibration. The final values of hydrologic parameters by are listed by segment in the user's control input file provided as Appendix C.

TABLE 6-1
Summary of Key Hydrologic Calibration Parameters

PWATER Parameter	Description	Adjustment and Rationale
INFILT	Index to infiltration capacity of soil.	Adjusted to match storm volumes, peaks
LZSN	Lower soil zone storage capacity	Increased to simulate more ET losses
UZSN	Upper soil zone storage capacity	Increased to simulate more ET losses
DEEPFR	Fraction of groundwater lost to deep aquifers.	Adjusted to match baseflow volumes
AGWRC	Base flow recession rate	Reduced to match hydrograph recession rates
INTFW	Interflow inflow parameter	Reduced to match hydrograph recession rates
LZETP	Lower zone evapotranspiration parameter	Increased to simulate more ET losses under low flow conditions.

Model predictions of streamflow were compared and calibrated to stream gage data in the following order:

- USGS: Pinto Creek Below Haunted Canyon (PC-200)
- USGS: Pinto Creek at the Pinto Valley Weir (PC-300)
- ADEQ: Estimated streamflow in Pinto Creek above Gibson
- ADEQ: Estimated streamflow the Gibson tributary
- ADEQ: Estimated streamflow at PC-100

The hydrologic calibration was performed on the USGS gages first because these stations have more reliable rating curves based on many accurate streamflow measurements. Rating curves for the ADEQ stations were estimated with the aid of limited streamflow measurements, and thus the streamflow data are not expected to be as accurate as the USGS data. Nevertheless, streamflow estimates derived from the ADEQ stations are useful for calibration of storm peak timing and order-of-magnitude volume. Following are notes on the hydrologic calibration at individual stations:

PC-200: An excellent calibration was achieved to the hydrographs of most major storms at this station (Figure 6-1), both in terms of timing, volume, and recession rate. The HSPF model predicts small storm peaks during dry summer conditions when no flow was actually observed at the station. This is primarily caused by evaporation and infiltration of small stormflows into the creek bed alluvium under dry weather conditions. The simulated peaks were reduced by increasing parameters related to land surface and riparian evapotranspiration. However, to eliminate the small peaks from model simulations it was necessary to explicitly model groundwater infiltration from the Pinto Creek channel. This in turn had an adverse effect on the stormflow recession calibration under wet seasonal conditions, when much less infiltration occurs. Because the model will be primarily applied to wet weather conditions, it was decided to maintain the superior calibration to the stormflow conditions.

PC-300: A good calibration was achieved to stormflow timing and recession at the Pinto Valley Weir/PC-300 (Figure 6-2). There was a higher degree of discrepancy in the stormflow volumes than at PC-200, probably due to the significantly large drainage area which allows for more variance between modeled and actual precipitation distributions across the basin. As at PC-200, the calibration is better for stormflow conditions than for dry weather flow conditions. PC-300 experiences remarkably stable perennial flows that have pattern of a near-constant point source flow, probably derived from groundwater discharges from the alluvium. The relative poor calibration to these low flows is primarily due to the fact that this baseflow does not exhibit an exponential recession curve following storms as assumed by the HSPF algorithm.

ADEQ stage measurement stations: After calibration to the USGS streamflow data, only relatively minor adjustments to infiltration rates were necessary to calibrate stormflows to estimated streamflow data at ADEQ stations (Figures 6-3 through 6-5). Discrepancies at these stages were interpreted as to whether they were more likely due to inaccuracy of the HSPF simulation, the WinXSPRO rating curve estimation, or both. The apparently “observed” baseflow recession curves at the Pinto Creek above Gibson station were caused by the slow evaporation of water in a pool at the staging site, and so the model was not adjusted to simulate this baseflow pattern. The HSPF model also seemingly overestimates storm volumes at PC-100. However, a comparison of estimated streamflow data from the three ADEQ stations indicated that the WINXSPRO-derived rating curve probably underestimated streamflow at this location.

Summary of Hydrologic Calibration: Due to the extended drought, relatively few large storm events were available upon which to calculate hydrologic calibration statistics. However, graphical comparison of observed v. simulated stream shows that HSPF model correctly predicts the timing, and recession rates of most major storm events, and correctly predicts the order-of-magnitude of stormflow volumes without systematic overprediction or underprediction. The calibration to stormflow volumes is superior in the upper basin (represented by PC-200), where there is greater confidence in the precipitation distribution based on the monitoring data. The model was primarily calibrated to wet-weather, stormflow conditions that represent the critical hydrologic conditions for attainment of the dissolved copper criterion. As currently formulated, it should be applied to stormflow conditions rather than used to predict baseflows during dry seasonal conditions.

PARAMETER ESTIMATION/CALIBRATION 6

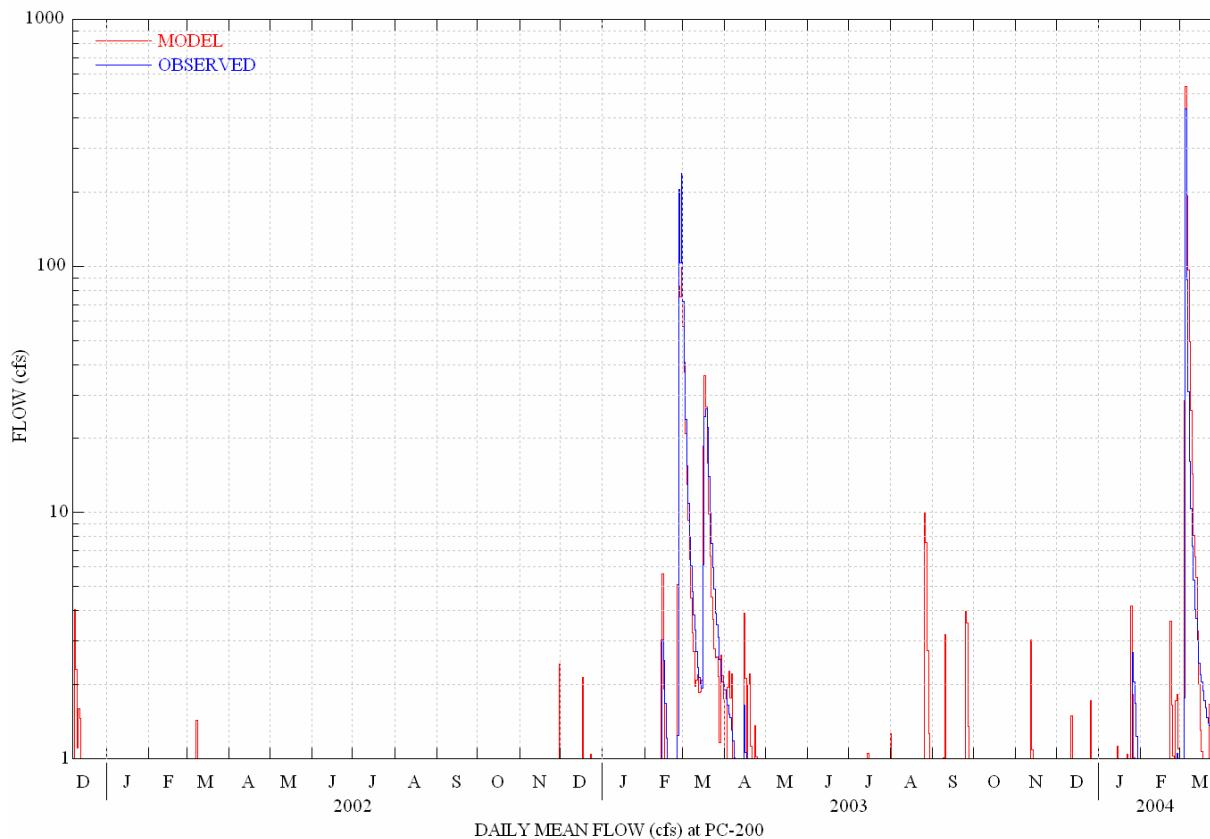


Figure 6-1: Observed and simulated streamflow in Pinto Creek below Haunted Canyon (PC-200).

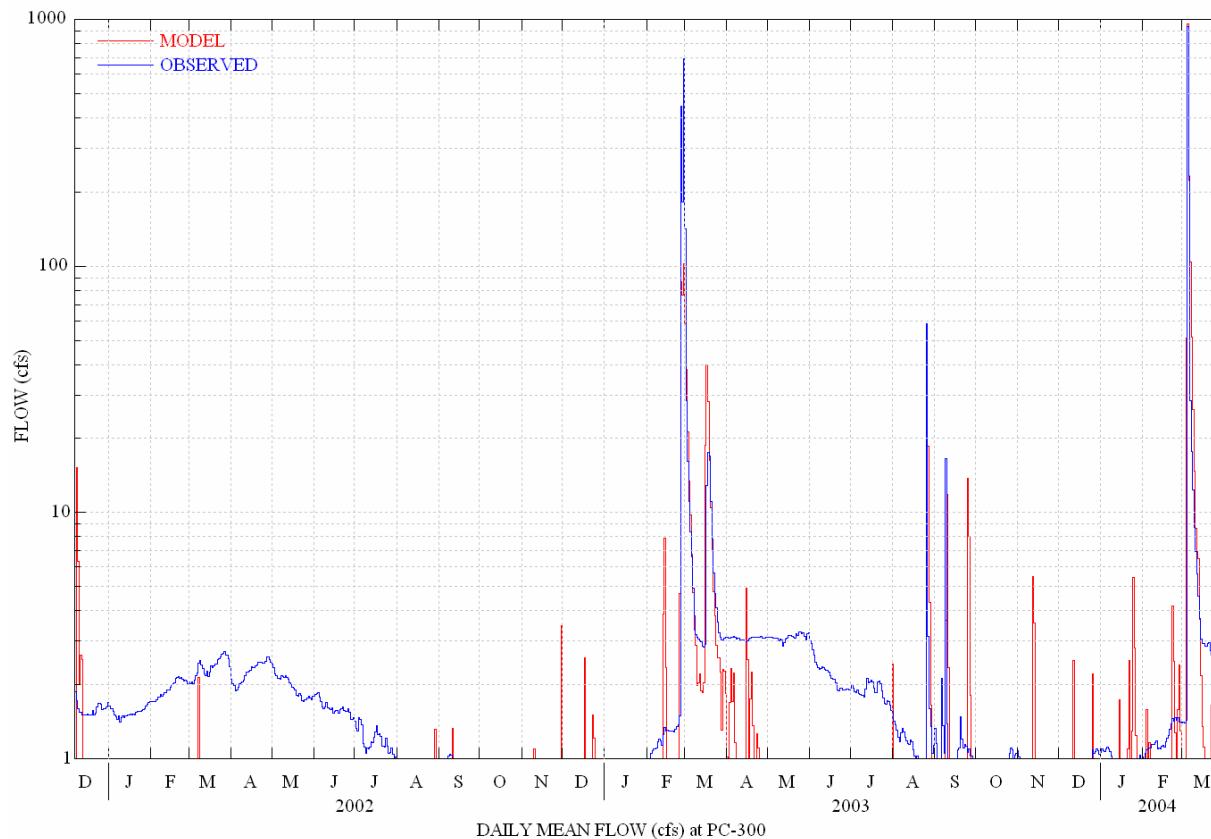


Figure 6-2: Observed and simulated streamflow in Pinto Creek at the Pinto Valley Weir (PC-300).

PARAMETER ESTIMATION/CALIBRATION 6

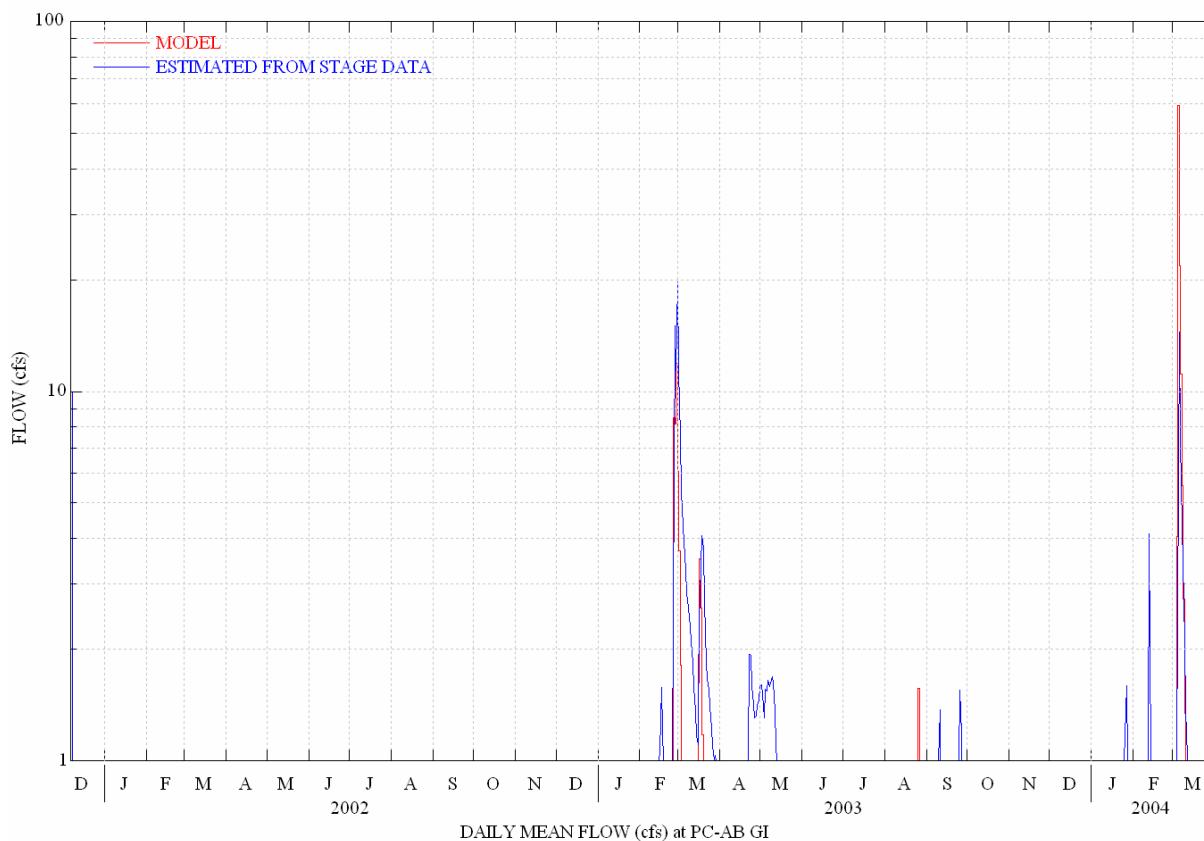


Figure 6-3: Observed and estimated streamflow in Pinto Creek above the Gibson tributary.

PARAMETER ESTIMATION/CALIBRATION 6

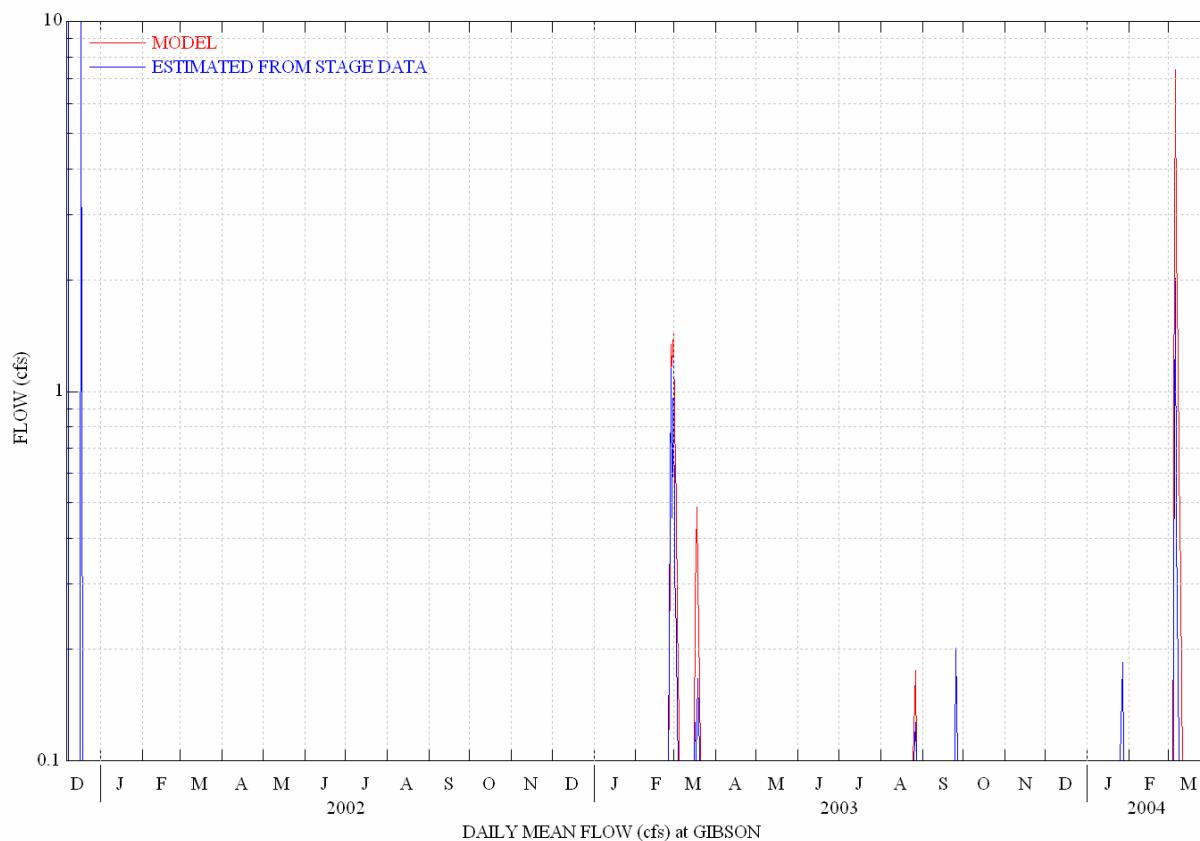


Figure 6-4: Observed and estimated streamflow in the Gibson tributary.

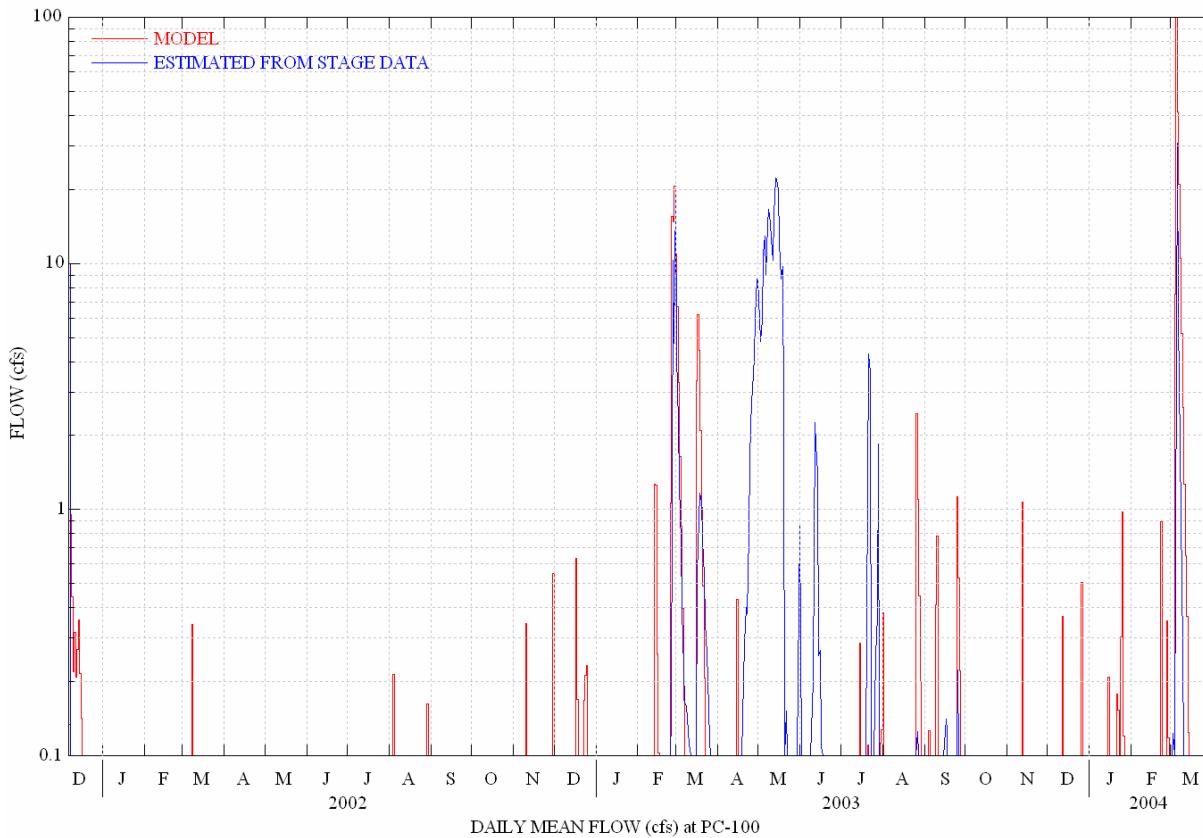


Figure 6-5: Observed and estimated streamflow at PC-100.

6.3 WATER QUALITY SENSITIVITY AND CALIBRATION

The water quality calibration was achieved adjusting the simulated concentrations of dissolved copper in runoff and seepage (interflow and baseflow) for various geology/land cover types and mining-related sources to achieve a match between observed and simulated dissolved copper concentrations in the stream. Because the background dissolved copper concentrations were well-established based on monitoring for most of the upper Pinto Creek basin, the calibration focused on copper loads from the most significant mining-related sources (Ellis, Henderson Ranch, Gibson, Bronx, Old Highway 60, and Yo Tambien mines) and the Cactus Breccia formation. Minor increases or decreases in background concentrations were made to account for more or less mining disturbance in selected subbasins. The water quality calibration was also achieved by reduction of copper loads between key stations to account for observed in-stream losses. The final dissolved copper concentration simulated from each previous land segment are listed in Appendix B (Table B-2).

The water quality calibration proceeded from upstream to downstream. Following are notes on the water quality calibration at specific locations:

PARAMETER ESTIMATION/CALIBRATION 6

Pinto Creek above Henderson Ranch Mines: Simulated dissolved copper concentrations in segments of subbasin 1 were slightly lowered to account for the lower observed dissolved copper concentrations (average = ~10 µg/L) near Simpson Dam and above Henderson Ranch Mines. Although the Ellis Mine occurs above this point, loads from this mine were not increased above background loads to avoid overpredicting concentrations near Simpson Dam.

Pinto Creek below Henderson Ranch Mines: Runoff and baseflow/interflow copper loads from the Henderson Ranch Mines were independently decreased to account for the decreased dissolved copper concentration below the mines; i.e., above the Gibson tributary. The baseflow/interflow values were decreased independent of, and to a greater degree than, the runoff load to accurately represent the minimal load expected from Henderson Ranch Mines under dry conditions.

Gibson Tributary and PC-100: Copper loads from the Gibson mine were decreased to account for over estimation of dissolved copper concentrations in the Gibson tributary near the confluence with Pinto Creek and at PC-100. Figure 6-6 displays the copper calibration plot for the February-March 2003 storm in the Gibson tributary and PC-100, which is the best-sampled event of the calibration period. Over the course of a storm, observed concentrations in the Gibson tributary remained at the same order-of-magnitude but have a relatively high variance. The final calibration values for Gibson were therefore strongly influenced by monitoring data at PC-100.

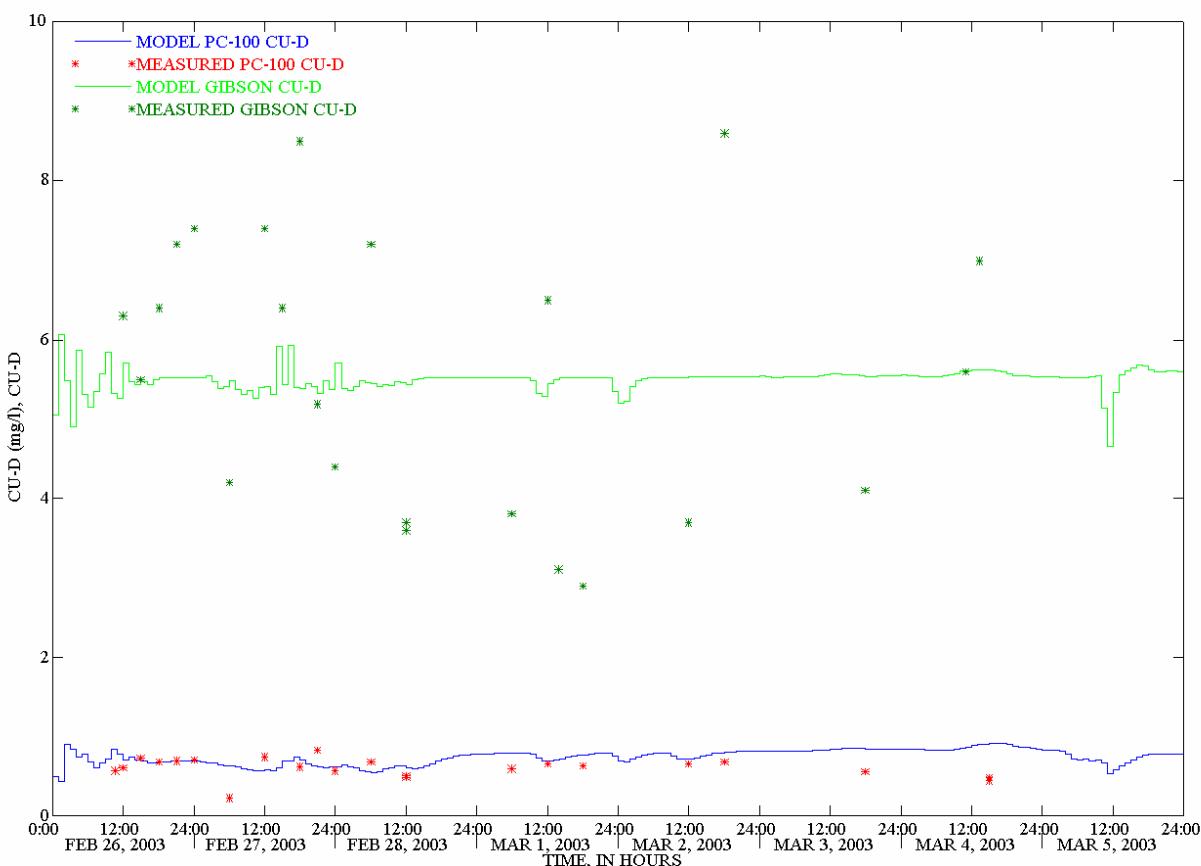


Figure 6-6: Water quality calibration plot for February-March 2003 storm in the Gibson tributary.

Subbasin 9: Loads from subbasin 9 to Pinto Creek reflect contributions from the Bronx Mine and the Old Highway 60 mine. Dissolved copper concentrations were elevated even upstream of the mines, however, probably due to both natural and mining-related sources. No further loading modifications were necessary for subbasin 9, following the updates made to the simulated background loads from the granite pervious land segments.

Cactus Breccia: Model results indicated that the large decreases in concentration between PC-100 and the creek upstream of the Cactus Breccia could not be accounted for by dilution alone. The load passing from reach 8 to reach 11 was therefore reduced to simulate in-stream losses in the 3-4 mile segment between these two points. Contributions from the Cactus Breccia itself were calibrated to simulate the observed increase in dissolved copper concentration downstream of this unit at both BHP and ADEQ station. The modeled concentration in runoff and seepage from the Cactus Breccia were approximately one order of magnitude higher than from other background lithologies.

PC-200: After calibration of upstream locations, no adjustments to simulated dissolved copper concentrations were necessary to calibrate the model to observed concentration at PC-200.

PC-300: Loads between segments 20 and 32 were reduced to account for observed in-stream losses between PC-200 and PC-300.

Basin Exit: Few dissolved copper data are available for the basin exit. Hydrologic parameters of PERLNDs in the lower basin (subbasin 33) were adjusted to cause little runoff to be simulated from the lower basin, causing concentrations and loads at the basin exit to be similar to those at PC-300, as has been observed.

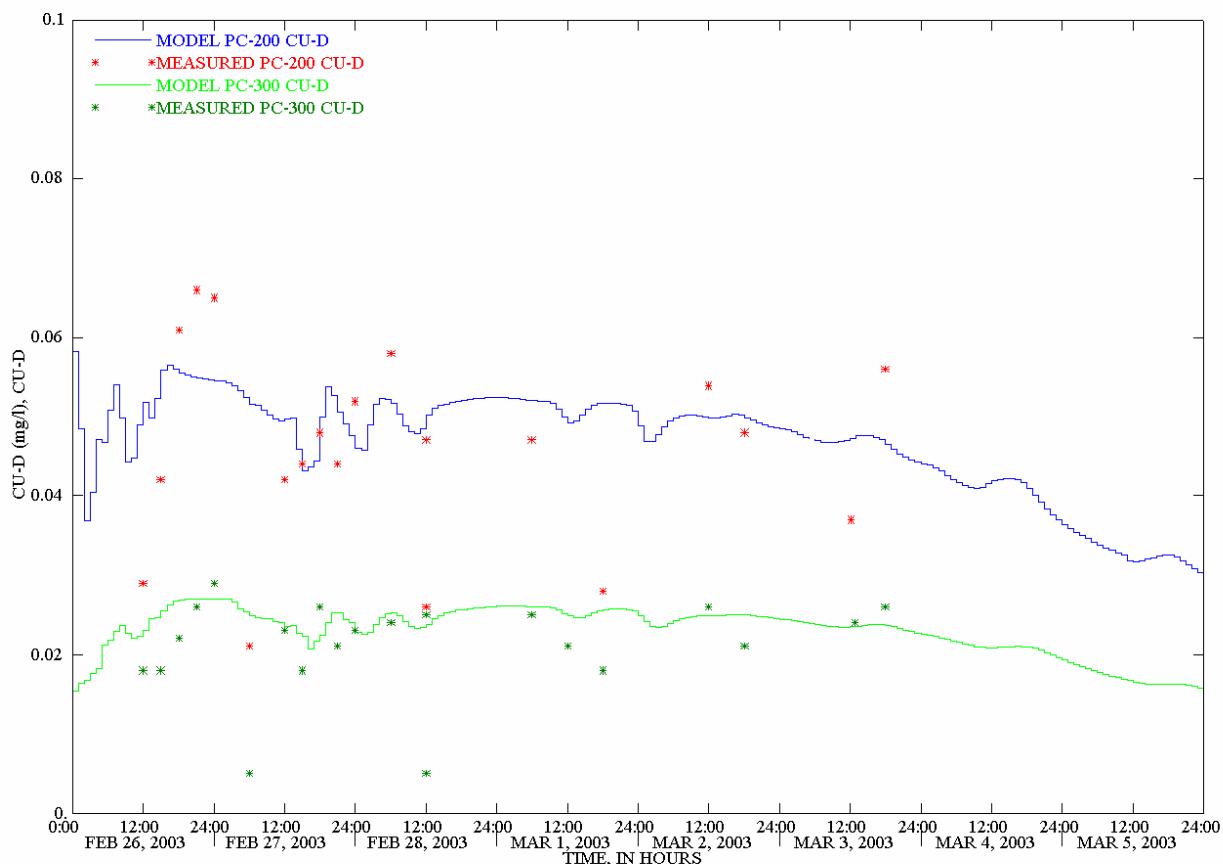


Figure 6-7: Water quality calibration plot for February-March 2003 storm at PC-200 (below Haunted Canyon) and PC-300 (Pinto Valley Weir).

Summary of Water Quality Calibration: The HSPF model is well calibrated to predict the typical dissolved copper concentrations and loads observed in stormflow and interflow in the Pinto Creek basin. Because the hydrologic calibration was focused on stormflow conditions rather than dry-weather baseflow conditions, the model is most appropriately used to simulate dissolved copper concentrations and loads under stormflow conditions.

PREDICTIVE SIMULATIONS

After calibration of the HSPF model to observed 2001-2004 conditions, the Pinto Creek model was used to evaluate eight different model scenarios that represent patterns of source loading to Pinto Creek. Output from the model scenarios was interpreted to determine how various alternatives would affect the concentrations and loads of copper at various locations in the Pinto Creek basin.

7.1 MODEL SCENARIOS

Model scenarios (Table 7-1) were formulated as follows:

1. Current conditions: This scenario includes all sources as included in the calibration run, and serves as the base scenario for comparison of the results of other scenarios.
2. Gibson remediated: This scenario was identical to scenario 1 except that it was assumed that loading from Gibson Mine was reduced to approximately 10 times natural background loading, which represents an approximate 99.9-percent reduction from current conditions
3. Gibson and miscellaneous mines remediated: This scenario was identical to scenario 2 except that it was also assumed that the Henderson Ranch, Gibson, Bronx, Old Highway 60, and Yo Tambien mines were remediated to approximately 10 times natural background loading, which represents an approximate 95-percent reduction from current conditions.
4. Background/ambient: This scenario was identical to scenario 3 except that discharge from BHP outfall 005 was also removed from the simulation. Note that all current drainage diversions, such as those associated with BHP's tailings piles, were retained in the simulation, because these diversions are considered to continue in perpetuity.

The background/ambient scenario is the most appropriate scenario for the derivation of a site-specific objective (SSO) for Pinto Creek, because it represents the best water quality that can be expected with remediation or removal of anthropogenic copper sources. As in scenario 3, it was assumed that the Henderson Ranch, Gibson, Bronx, Old Highway 60, and Yo Tambien mines were remediated to approximately 10 times natural background loading, which represents an approximate 95-percent reduction from current conditions. The remaining load from these sources represents (1) copper that is naturally elevated above diffuse background levels at minable locations; and (2) residual anthropogenic copper that would be expected to remain even after the best available remedial technology was applied.

5. Current & Carlota (1997): This scenario was identical to scenario 1 except that the Carlota Copper Project was included in the scenario, assuming discharge from the Main Rock Area and Eder Rock Area at storms greater than the 10-year, 24-hour event. Dissolved copper concentration in runoff from the areas were set as 35 and 26 µg/L for the Main and Eder Rock Areas, respectively, based on the maximum concentrations as summarized by USEPA (2001). Loadings from the Cactus Breccia formation were

reduced to the same level as surrounding lithologies, to account for the Pinto Creek channel diversion and mining of the Cactus Breccia formation.

6. Carlota (1997) and Gibson remediated: This scenario was identical to scenario 5 except that loading from the Gibson Mine was also reduced to approximately 10 times natural background loading.
7. Current & Carlota (2004): This scenario was identical to scenario 1 except that the Carlota Copper Project was included in the scenario, assuming no discharges from the project at storm events up to and including the 100-year, 24-hour event. Loadings from the Cactus Breccia formation were reduced to the same level as surrounding lithologies, to account for the Pinto Creek channel diversion and mining of the Cactus Breccia formation.
8. Carlota (2004) and Gibson remediated: This scenario was identical to scenario 7 except that loading from the Gibson Mine was also reduced to approximately 10 times natural background loading.

TABLE 7-1
Summary of Model Scenarios

Scenario	Current BHP Facilities	BHP Outfall 005	Carlota w/ NPDES ¹	Carlota w/o NPDES ²	Carlota Cactus Diversion	Gibson Mine Remed.	Misc. Mines ³ Remed.
1. Current	Yes	Yes	No	No	No	Yes	Yes
2. Gibson Remediated	Yes	Yes	No	No	No	No	Yes
3. Gibson & Misc. Mines Remediated	Yes	Yes	No	No	No	No	No
4. Natural Background/Ambient ⁴	Yes	No	No	No	No	No	No
5. Current + Carlota (1997)	Yes	Yes	Yes	No	Yes	Yes	Yes
6. Carlota (1997) & Gibson Remediated	Yes	Yes	Yes	No	Yes	No	Yes
7. Current + Carlota (2004)	Yes	Yes	No	Yes	Yes	Yes	Yes
8. Carlota (2004) & Gibson Remediated	Yes	Yes	No	Yes	Yes	No	Yes

¹Carlota facilities as presented in USFS 1997 final EIS

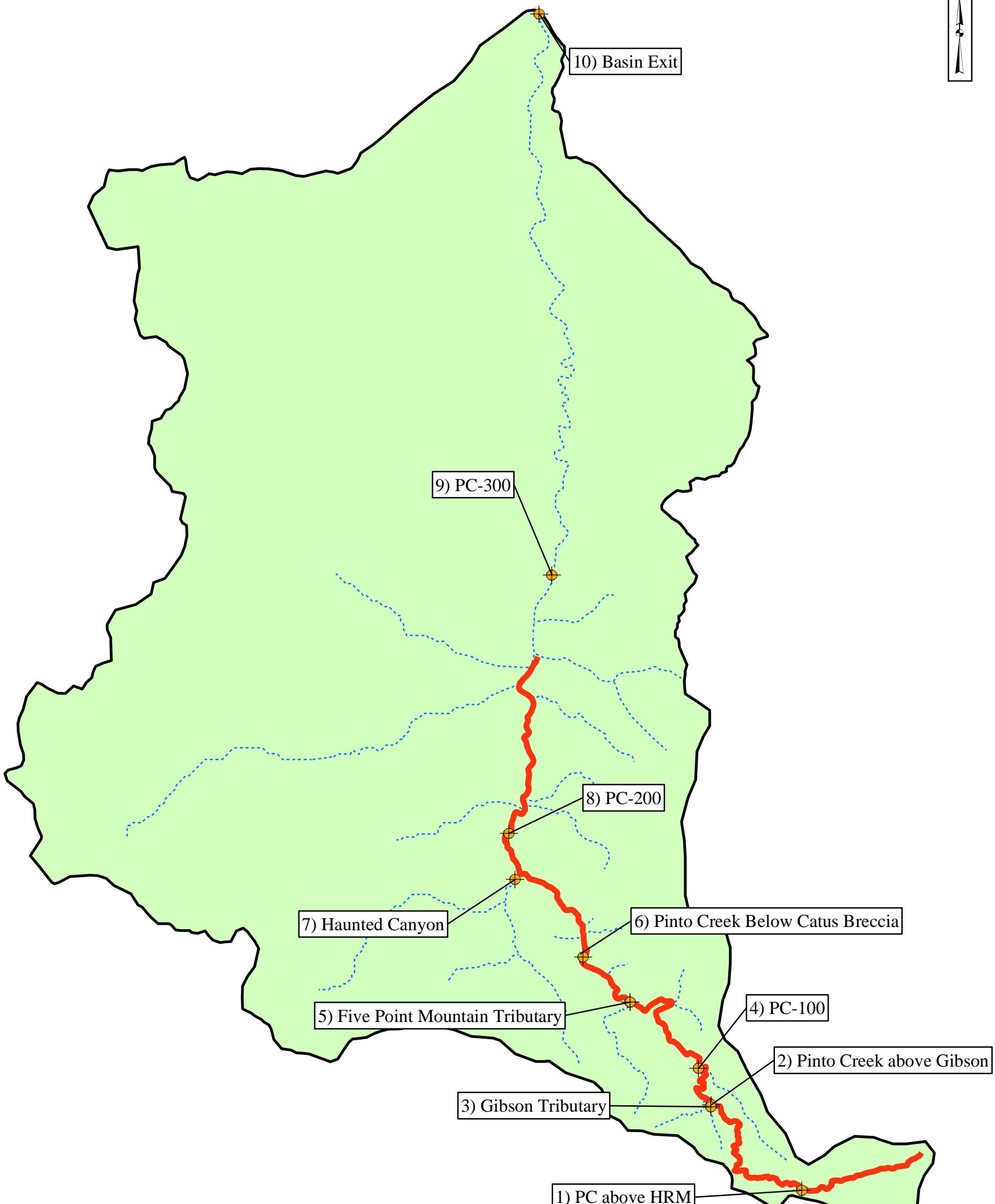
²Carlota facilities as presented in USFS 1997 final EIS, but non-discharging below 100-year event (2004 design)

³Includes Henderson, Bronx, Yo Tambien, Ellis and Old Highway 60 Mine

⁴Includes all existing permanent hydrologic alterations (i.e., BHP pits, ponds and diversions)

7.2 HYDROLOGIC CONDITIONS

HSPF model scenarios were run using the entire record of meteorological data used for calibration the year 2003, and for five different types of storm events to evaluate the benefits of remedial scenarios under a range of hydrologic/seasonal conditions (Table 7-2). The magnitudes of storm events were obtained from the NOAA Atlas 14 precipitation frequency estimates. The 2-yr, 1-hour storm event was modeled as the most intense hour of a SCS Type II frequency distribution for a 24-hour storm, to represent a large monsoon event. All 24-hour storm events were modeled using an SCS Type IA frequency to more accurately simulate less intense, more prolonged storms.



Legend

- Model Output Locations
- Pinto Creek and Tributaries
- 303(d)-listed segment
- Pinto Creek Watershed

0 1 2 4 6
Miles

**MALCOLM
PIRNIE**

4646 E. Van Buren St.
Phoenix, AZ 85008

Model Output Locations

Figure 7-1

February 2006

TABLE 7-2
Hydrologic Events for Model Scenarios

Storm Event	Magnitude (inches)
2-year, 1-hour	1.03
2-year, 24-hour	2.50
10-year, 24-hour	3.64
25-year, 24-hour	4.35
100-year, 24-hour	5.51

7.3 MODEL SCENARIO OUTPUT TYPE AND LOCATION

The HSPF model was designed to output time series of in-stream dissolved copper concentration and copper load at the following locations (Figure 7-1) for each scenario and storm event:

1. Pinto Creek above Henderson Ranch Mines (output from reach 1)
2. Pinto Creek above the Gibson Tributary (output from reach 2)
3. Gibson tributary (output from reach 3)
4. PC-100 (output from reach 8)
5. Five Point Mountain Tributary (*formerly Un-named Trib #2*) (output from reach 9)
6. Pinto Creek Below Cactus Breccia (output from reach 11)
7. Haunted Canyon (output from reach 19)
8. Pinto Creek below Haunted Canyon / PC-200 (output from reach 20)
9. Pinto Valley Weir / PC-300 (output from reach 32)
10. Basin exit to Lake Roosevelt (output from reach 33)

The Pinto Creek HSPF model was also designed to output time series of copper loads from individual sources (Figure 1-4), including:

1. Ellis Mine
2. Henderson Ranch Mines
3. Gibson Mine
4. Bronx Mine
5. Old Highway 60 Mine
6. Yo Tambien Mine
7. Carlota Facilities
8. BHP Outfall 005

7.4 SCENARIO RESULTS

Output of the HSPF model scenarios is summarized in Table 7-3 (predicted dissolved copper concentrations by scenario, storm event, and location), Table 7-4 (24-hour in-stream copper loads by scenario, storm event, and location), and Table 7-5 (24-hour source loads by scenario, storm event, and mining-related source).

1. Current conditions: As expected, this scenario predicted dissolved copper concentrations of a similar order of magnitude as observed for the calibration period, with the highest concentration in the Gibson tributary (5.2 -6.3 mg/L) and at PC-100 (0.3 mg/L). Chronic

TABLE 7-3
Model Predictions of Dissolved Copper Concentrations ($\mu\text{g/L}$)

Location	Scenario	Storm Event				
		2-yr, 1-hr	2-yr, 24-hr	10-yr, 24-hr	25-yr, 24-hr	100-yr, 24-hr
1. Pinto Cr above Henderson Ranch Mines Chronic criterion = 16.2 $\mu\text{g Cu/L}$ Acute criterion = 25.8 $\mu\text{g Cu/L}$	1. Current Conditions	11	11	11	11	11
	2. Gibson Remediated	11	11	11	11	11
	3. Gibson & Misc. Mines Remediated	11	11	11	11	11
	4. Natural Background/Ambient	11	11	11	11	11
	5. Current + Carlota (1997)	11	11	11	11	11
	6. Carlota (1997) & Gibson Remediated	11	11	11	11	11
	7. Current + Carlota (2004)	11	11	11	11	11
	8. Carlota (2004) & Gibson Remediated	11	11	11	11	11
2. Pinto Creek above Gibson Chronic criterion = 6.6 $\mu\text{g Cu/L}$ Acute criterion = 9.6 $\mu\text{g Cu/L}$	1. Current Conditions	29	19	26	27	27
	2. Gibson Remediated	29	19	26	27	27
	3. Gibson & Misc. Mines Remediated	22	17	21	21	22
	4. Natural Background/Ambient	22	17	21	21	22
	5. Current + Carlota (1997)	29	19	26	27	27
	6. Carlota (1997) & Gibson Remediated	29	19	26	27	27
	7. Current + Carlota (2004)	29	19	26	27	27
	8. Carlota (2004) & Gibson Remediated	29	19	26	27	27
3. Gibson Tributary Chronic criterion = 6.1 $\mu\text{g Cu/L}$ Acute criterion = 8.8 $\mu\text{g Cu/L}$	1. Current Conditions	6,277	5,249	5,978	6,020	6,058
	2. Gibson Remediated	50	52	48	49	49
	3. Gibson & Misc. Mines Remediated	50	52	48	49	49
	4. Natural Background/Ambient	50	52	48	49	49
	5. Current + Carlota (1997)	6,289	5,249	5,972	6,019	6,063
	6. Carlota (1997) & Gibson Remediated	50	52	48	49	49
	7. Current + Carlota (2004)	6,289	5,249	5,972	6,019	6,063
	8. Carlota (2004) & Gibson Remediated	50	52	48	49	49
4. PC-100 Chronic criterion = 8.2 $\mu\text{g Cu/L}$ Acute criterion = 12.2 $\mu\text{g Cu/L}$	1. Current Conditions	323	271	316	306	298
	2. Gibson Remediated	32	21	29	30	30
	3. Gibson & Misc. Mines Remediated	28	19	26	27	27
	4. Natural Background/Ambient	28	19	26	27	27
	5. Current + Carlota (1997)	325	275	316	306	298
	6. Carlota (1997) & Gibson Remediated	32	21	29	30	30
	7. Current + Carlota (2004)	325	275	316	306	298
	8. Carlota (2004) & Gibson Remediated	32	21	29	30	30
5. Un-named Tributary #2 Chronic criterion = 1.8 mg Cu/L Acute criterion = 2.3 mg Cu/L	1. Current Conditions	120	106	117	118	118
	2. Gibson Remediated	120	106	117	118	118
	3. Gibson & Misc. Mines Remediated	42	36	42	42	42
	4. Natural Background/Ambient	42	36	42	42	42
	5. Current + Carlota (1997)	120	106	117	118	118
	6. Carlota (1997) & Gibson Remediated	120	106	117	118	118
	7. Current + Carlota (2004)	120	106	117	118	118
	8. Carlota (2004) & Gibson Remediated	120	106	117	118	118
6. Below Catus Breccia Chronic criterion = 22.8 mg Cu/L Acute criterion = 37.7 mg Cu/L	1. Current Conditions	102	88	101	100	99
	2. Gibson Remediated	37	28	34	34	34
	3. Gibson & Misc. Mines Remediated	34	28	32	31	30
	4. Natural Background/Ambient	34	28	32	31	30
	5. Current + Carlota (1997)	104	89	102	101	99
	6. Carlota (1997) & Gibson Remediated	35	27	33	33	32
	7. Current + Carlota (2004)	104	89	102	101	99
	8. Carlota (2004) & Gibson Remediated	35	27	33	33	32
7. Haunted Canyon Chronic criterion = 14.1 $\mu\text{g Cu/L}$ Acute criterion = 22.2 $\mu\text{g Cu/L}$	1. Current Conditions	12	11	12	12	12
	2. Gibson Remediated	12	11	12	12	12
	3. Gibson & Misc. Mines Remediated	12	11	12	12	12
	4. Natural Background/Ambient	12	11	12	12	12
	5. Current + Carlota (1997)	11	11	11	12	12
	6. Carlota (1997) & Gibson Remediated	11	11	11	12	12
	7. Current + Carlota (2004)	11	11	11	11	12
	8. Carlota (2004) & Gibson Remediated	11	11	11	11	12
8. PC-200 Chronic criterion = 12.7 $\mu\text{g Cu/L}$ Acute criterion = 19.7 $\mu\text{g Cu/L}$	1. Current Conditions	43	38	45	46	47
	2. Gibson Remediated	22	18	21	22	22
	3. Gibson & Misc. Mines Remediated	21	18	20	20	20
	4. Natural Background/Ambient	21	18	20	21	20
	5. Current + Carlota (1997)	43	37	45	46	46
	6. Carlota (1997) & Gibson Remediated	21	17	20	21	21
	7. Current + Carlota (2004)	43	37	45	46	47
	8. Carlota (2004) & Gibson Remediated	21	17	20	21	21
9. PC-300 Chronic criterion = 29.3 $\mu\text{g Cu/L}$ Acute criterion = 49.6 $\mu\text{g Cu/L}$	1. Current Conditions	24	19	25	26	27
	2. Gibson Remediated	13	10	13	13	13
	3. Gibson & Misc. Mines Remediated	13	10	12	12	12
	4. Natural Background/Ambient	13	10	12	12	12
	5. Current + Carlota (1997)	23	19	25	26	27
	6. Carlota (1997) & Gibson Remediated	13	10	12	12	12
	7. Current + Carlota (2004)	23	19	25	26	27
	8. Carlota (2004) & Gibson Remediated	13	10	12	12	12
10. Basin Exit Chronic criterion = 16.6 $\mu\text{g Cu/L}$ Acute criterion = 26.4 $\mu\text{g Cu/L}$	1. Current Conditions	20	17	25	26	27
	2. Gibson Remediated	13	9	12	13	13
	3. Gibson & Misc. Mines Remediated	13	9	12	12	12
	4. Natural Background/Ambient	13	9	12	12	12
	5. Current + Carlota (1997)	20	17	25	26	27
	6. Carlota (1997) & Gibson Remediated	12	9	12	12	12
	7. Current + Carlota (2004)	20	17	25	26	27
	8. Carlota (2004) & Gibson Remediated	12	9	12	12	12

Max value exceeds acute criterion

Max value exceeds chronic criterion

TABLE 7-4
Model Predictions of 24-Hour In-Stream Loads (kg) of Dissolved Copper

Location	Scenario	Storm Event				
		2-yr, 1-hr	2-yr, 24-hr	10-yr, 24-hr	25-yr, 24-hr	100-yr, 24-hr
1. Pinto Cr above Henderson Ranch Mines	1. Current Conditions	0.371	0.118	0.744	1.513	2.665
	2. Gibson Remediated	0.370	0.118	0.744	1.511	2.666
	3. Gibson & Misc. Mines Remediated	0.370	0.118	0.744	1.511	2.666
	4. Natural Background/Ambient	0.370	0.118	0.744	1.511	2.666
	5. Current + Carlot (1997)	0.370	0.118	0.744	1.511	2.666
	6. Carlot (1997) & Gibson Remediated	0.370	0.118	0.744	1.511	2.666
	7. Current + Carlot (2004)	0.370	0.118	0.744	1.511	2.666
	8. Carlot (2004) & Gibson Remediated	0.370	0.118	0.744	1.511	2.666
2. Pinto Creek above Gibson	1. Current Conditions	1.929	0.371	3.389	7.021	12.704
	2. Gibson Remediated	1.931	0.371	3.390	7.025	12.699
	3. Gibson & Misc. Mines Remediated	1.513	0.318	2.727	5.628	10.127
	4. Natural Background/Ambient	1.513	0.318	2.727	5.628	10.127
	5. Current + Carlot (1997)	1.931	0.371	3.390	7.025	12.699
	6. Carlot (1997) & Gibson Remediated	1.931	0.371	3.390	7.025	12.699
	7. Current + Carlot (2004)	1.931	0.371	3.390	7.025	12.699
	8. Carlot (2004) & Gibson Remediated	1.931	0.371	3.390	7.025	12.699
3. Gibson Tributary	1. Current Conditions	44,186	10,354	81,086	161,949	273,059
	2. Gibson Remediated	0.361	0.114	0.668	1.323	2.221
	3. Gibson & Misc. Mines Remediated	0.361	0.114	0.668	1.323	2.221
	4. Natural Background/Ambient	0.361	0.114	0.668	1.323	2.221
	5. Current + Carlot (1997)	44,256	10,354	81,013	161,938	273,306
	6. Carlot (1997) & Gibson Remediated	0.361	0.114	0.668	1.323	2.221
	7. Current + Carlot (2004)	44,256	10,354	81,013	161,938	273,306
	8. Carlot (2004) & Gibson Remediated	0.361	0.114	0.668	1.323	2.221
4. PC-100	1. Current Conditions	38,659	8,465	69,582	140,476	238,379
	2. Gibson Remediated	3,926	0.689	6,535	13,825	24,156
	3. Gibson & Misc. Mines Remediated	3,509	0.625	5,883	12,449	21,585
	4. Natural Background/Ambient	3,508	0.625	5,883	12,450	21,584
	5. Current + Carlot (1997)	38,632	8,465	69,571	140,565	238,499
	6. Carlot (1997) & Gibson Remediated	3,928	0.689	6,534	13,825	24,155
	7. Current + Carlot (2004)	38,632	8,465	69,571	140,565	238,499
	8. Carlot (2004) & Gibson Remediated	3,928	0.689	6,534	13,825	24,155
5. Un-named Tributary #2	1. Current Conditions	3.716	0.684	6,310	12,795	21,364
	2. Gibson Remediated	3.716	0.684	6,308	12,796	21,357
	3. Gibson & Misc. Mines Remediated	1.318	0.237	2,232	4,524	7,536
	4. Natural Background/Ambient	1.318	0.237	2,232	4,524	7,536
	5. Current + Carlot (1997)	3.716	0.684	6,308	12,796	21,357
	6. Carlot (1997) & Gibson Remediated	3.716	0.684	6,308	12,796	21,357
	7. Current + Carlot (2004)	3.716	0.684	6,308	12,796	21,357
	8. Carlot (2004) & Gibson Remediated	3.716	0.684	6,308	12,796	21,357
6. Below Catus Breccia	1. Current Conditions	21,582	4,464	38,070	76,900	129,876
	2. Gibson Remediated	7,764	1,447	13,014	26,477	44,468
	3. Gibson & Misc. Mines Remediated	7,190	1,430	11,983	24,052	40,115
	4. Natural Background/Ambient	7,189	1,432	11,983	24,052	40,114
	5. Current + Carlot (1997)	21,013	4,331	37,123	75,047	126,689
	6. Carlot (1997) & Gibson Remediated	7,189	1,317	12,051	24,615	41,442
	7. Current + Carlot (2004)	21,013	4,331	37,123	75,047	126,689
	8. Carlot (2004) & Gibson Remediated	7,189	1,317	12,051	24,615	41,442
7. Haunted Canyon	1. Current Conditions	4,208	0.894	6,582	12,719	20,736
	2. Gibson Remediated	4,214	0.891	6,579	12,718	20,722
	3. Gibson & Misc. Mines Remediated	4,214	0.891	6,579	12,718	20,722
	4. Natural Background/Ambient	4,214	0.891	6,579	12,718	20,722
	5. Current + Carlot (1997)	3,994	0.861	6,284	12,319	20,423
	6. Carlot (1997) & Gibson Remediated	3,994	0.861	6,284	12,319	20,423
	7. Current + Carlot (2004)	3,977	0.851	6,199	11,966	19,524
	8. Carlot (2004) & Gibson Remediated	3,977	0.851	6,199	11,966	19,524
8. PC-200	1. Current Conditions	27,625	5,553	47,260	94,749	159,171
	2. Gibson Remediated	13,889	2,624	22,399	44,660	74,308
	3. Gibson & Misc. Mines Remediated	13,321	2,619	21,358	42,242	69,980
	4. Natural Background/Ambient	13,322	2,621	21,356	42,250	69,980
	5. Current + Carlot (1997)	26,627	5,359	45,690	91,874	154,802
	6. Carlot (1997) & Gibson Remediated	12,901	2,433	20,815	41,792	69,957
	7. Current + Carlot (2004)	26,602	5,326	45,598	91,509	153,867
	8. Carlot (2004) & Gibson Remediated	12,875	2,413	20,728	41,414	69,056
9. PC-300	1. Current Conditions	18,613	3,578	29,855	59,943	100,427
	2. Gibson Remediated	10,429	1,840	14,874	29,271	47,438
	3. Gibson & Misc. Mines Remediated	10,086	1,845	14,265	27,793	44,677
	4. Natural Background/Ambient	10,101	1,845	14,265	27,793	44,677
	5. Current + Carlot (1997)	18,013	3,466	28,909	58,229	97,729
	6. Carlot (1997) & Gibson Remediated	9,843	1,726	13,935	27,557	44,720
	7. Current + Carlot (2004)	17,994	3,444	28,853	57,998	97,185
	8. Carlot (2004) & Gibson Remediated	9,826	1,711	13,882	27,327	44,169
10. Basin Exit	1. Current Conditions	18,234	3,267	28,840	58,339	98,435
	2. Gibson Remediated	10,254	1,690	14,385	28,522	46,485
	3. Gibson & Misc. Mines Remediated	9,940	1,691	13,791	27,093	43,788
	4. Natural Background/Ambient	9,940	1,691	13,792	27,093	43,788
	5. Current + Carlot (1997)	17,650	3,168	27,928	56,644	95,726
	6. Carlot (1997) & Gibson Remediated	9,670	1,590	13,464	26,835	43,852
	7. Current + Carlot (2004)	17,628	3,143	27,875	56,417	95,200
	8. Carlot (2004) & Gibson Remediated	9,657	1,567	13,411	26,603	43,282

TABLE 7-5

Model Predictions of 24-Hour Loads (kg) of Dissolved Copper from Specific Sources

Source	Scenario	Storm Event				
		2-yr, 1-hr	2-yr, 24-hr	10-yr, 24-hr	25-yr, 24-hr	100-yr, 24-hr
1. Ellis Mine	1. Current Conditions	0.0012	0.0009	0.0067	0.01	0.0144
	2. Gibson Remediated	0.0012	0.0009	0.0067	0.01	0.0144
	3. Gibson & Misc. Mines Remediated	0.0012	0.0009	0.0067	0.01	0.0144
	4. Natural Background/Ambient	0.0012	0.0009	0.0067	0.01	0.0144
	5. Current + Carlota (1997)	0.0012	0.0009	0.0067	0.01	0.0144
	6. Carlota (1997) & Gibson Remediated	0.0012	0.0009	0.0067	0.01	0.0144
	7. Current + Carlota (2004)	0.0012	0.0009	0.0067	0.01	0.0144
	8. Carlota (2004) & Gibson Remediated	0.0012	0.0009	0.0067	0.01	0.0144
2. Henderson Ranch Mine (PC-SD)	1. Current Conditions	0.9979	0.8333	5.9541	8.8072	12.7197
	2. Gibson Remediated	0.9979	0.8333	5.9541	8.8072	12.7197
	3. Gibson & Misc. Mines Remediated	0.0181	0.0151	0.1086	0.151	0.2177
	4. Natural Background/Ambient	0.0181	0.0151	0.1086	0.151	0.2177
	5. Current + Carlota (1997)	0.9979	0.8333	5.9541	8.8072	12.7197
	6. Carlota (1997) & Gibson Remediated	0.9979	0.8333	5.9541	8.8072	12.7197
	7. Current + Carlota (2004)	0.9979	0.8333	5.9541	8.8072	12.7197
	8. Carlota (2004) & Gibson Remediated	0.9979	0.8333	5.9541	8.8072	12.7197
3. Gibson Mine	1. Current Conditions	39.4958	52.7468	231.7417	339.524	489.7802
	2. Gibson Remediated	0.0599	0.0799	0.3364	0.5302	0.7427
	3. Gibson & Misc. Mines Remediated	0.0599	0.0799	0.3364	0.5302	0.7427
	4. Natural Background/Ambient	0.0599	0.0799	0.3364	0.5302	0.7427
	5. Current + Carlota (1997)	39.4958	52.7468	231.7417	339.524	489.7802
	6. Carlota (1997) & Gibson Remediated	0.5991	0.0799	0.3364	0.5302	0.7427
	7. Current + Carlota (2004)	39.4958	52.7468	231.7417	339.524	489.7802
	8. Carlota (2004) & Gibson Remediated	0.0599	0.0799	0.3364	0.5302	0.7427
4. Bronx Mine	1. Current Conditions	1.0447	0.85	5.9802	8.8479	12.7531
	2. Gibson Remediated	1.0447	0.85	5.9802	8.8479	12.7531
	3. Gibson & Misc. Mines Remediated	0.0218	0.0177	0.1177	0.1729	0.25
	4. Natural Background/Ambient	0.0218	0.0177	0.1177	0.1729	0.25
	5. Current + Carlota (1997)	1.0447	0.85	5.9802	8.8479	12.7531
	6. Carlota (1997) & Gibson Remediated	1.0447	0.85	5.9802	8.8479	12.7531
	7. Current + Carlota (2004)	1.0447	0.85	5.9802	8.8479	12.7531
	8. Carlota (2004) & Gibson Remediated	1.0447	0.85	5.9802	8.8479	12.7531
5. Old Highway 60 Mine	1. Current Conditions	1.0447	0.85	5.9802	8.8479	12.7531
	2. Gibson Remediated	1.0447	0.85	5.9802	8.8479	12.7531
	3. Gibson & Misc. Mines Remediated	0.0218	0.0177	0.1177	0.1729	0.25
	4. Natural Background/Ambient	0.0218	0.0177	0.1177	0.1729	0.25
	5. Current + Carlota (1997)	1.0447	0.85	5.9802	8.8479	12.7531
	6. Carlota (1997) & Gibson Remediated	1.0447	0.85	5.9802	8.8479	12.7531
	7. Current + Carlota (2004)	1.0447	0.85	5.9802	8.8479	12.7531
	8. Carlota (2004) & Gibson Remediated	1.0447	0.85	5.9802	8.8479	12.7531
6. BHP005	1. Current Conditions	0.012	0.012	0.012	0.012	0.012
	2. Gibson Remediated	0.012	0.012	0.012	0.012	0.012
	3. Gibson & Misc. Mines Remediated	0.012	0.012	0.012	0.012	0.012
	4. Natural Background/Ambient	0	0	0	0	0
	5. Current + Carlota (1997)	0.012	0.012	0.012	0.012	0.012
	6. Carlota (1997) & Gibson Remediated	0.012	0.012	0.012	0.012	0.012
	7. Current + Carlota (2004)	0.012	0.012	0.012	0.012	0.012
	8. Carlota (2004) & Gibson Remediated	0.012	0.012	0.012	0.012	0.012
7. Yo Tambien Mine	1. Current Conditions	1.1864	1.1239	6.1208	8.9604	12.8458
	2. Gibson Remediated	1.1864	1.1239	6.1208	8.9604	12.8458
	3. Gibson & Misc. Mines Remediated	0.0245	0.0233	0.1197	0.176	0.251
	4. Natural Background/Ambient	0.0245	0.0233	0.1197	0.176	0.251
	5. Current + Carlota (1997)	1.1864	1.1239	6.1208	8.9604	12.8458
	6. Carlota (1997) & Gibson Remediated	1.1864	1.1239	6.1208	8.9604	12.8458
	7. Current + Carlota (2004)	1.1864	1.1239	6.1208	8.9604	12.8458
	8. Carlota (2004) & Gibson Remediated	1.1864	1.1239	6.1208	8.9604	12.8458
8. Carlota Copper Project	1. Current Conditions	0	0	0	0	0
	2. Gibson Remediated	0	0	0	0	0
	3. Gibson & Misc. Mines Remediated	0	0	0	0	0
	4. Natural Background/Ambient	0	0	0	0	0
	5. Current + Carlota (1997)	0	0	0	1.4764	2.084
	6. Carlota (1997) & Gibson Remediated	0	0	0	1.4764	2.084
	7. Current + Carlota (2004)	0	0	0	0	0
	8. Carlota (2004) & Gibson Remediated	0	0	0	0	0

dissolved copper criteria are predicted to be exceeded at 6 of 10 locations during all storms (Table 7-3). Acute dissolved copper criterion were predicted to be exceeded at most locations downstream of Henderson Ranch Mines, with the exception of PC-300 (the Pinto Valley Weir) and the Basin Exit.

Under the current conditions scenario, the Gibson mine is the single largest contributor of copper loads to the Pinto Creek; loads from this source were predicted to be almost 40 times larger than those of any other discrete mine-related source, and greater than all other sources (including background loads) combined. The Henderson Ranch, Bronx, Old Highway 60, and Yo Tambien mines were all predicted to contribute copper loads of similar magnitude. The Ellis mine and BHP outfall 005 were predicted to be relatively minor contributors of copper to the stream.

2. Gibson remediated: The Gibson remediation scenario predicted dramatic decreases in copper load and concentration in the Gibson tributary and at downstream PC-100. Peak concentrations at PC-100 decreased from approximately 300 µg/L under current conditions to less than 35 µg/L, and the total 24-hour load at this location decreased 99 percent. Chronic and acute dissolved copper standards were still predicted to be exceeded at PC-100 and PC-200, in part due to the low hardness concentrations that result in very low criteria.

Concentrations and loads at downstream station PC-300 were less sensitive to the remediation of the Gibson mine due to intervening sources and in-stream losses. The remediation was predicted to cause compliance with both acute and chronic water quality standards at PC-300 during all storm events.

3. Gibson and miscellaneous mines remediated: This scenario predicted modest decreases in dissolved copper concentrations and loads beyond those achieved by the remediation of the Gibson mine. Copper loads decreased an additional 10-11 percent at station PC-100, but concentrations remained above the chronic criteria. Copper loads were predicted to decrease by no more than 6 percent during any storm at stations PC-200 and PC-300.

The reason that dissolved copper criteria are still expected to be exceeded in many parts of the Pinto Creek Basin, even after remediation of the mines are: (1) elevated background dissolved copper concentration/loads, including those from the Cactus Breccia deposit; (2) relatively low hardness values throughout much of the upper basin; and (3) continuing contributions from mining-related sources that are unlikely to remediate all the way to background conditions.

4. Background/ambient: The results of this scenario were almost identical to that of scenario 3, because the contributions from BHP outfall 005 are negligible during stormflow conditions. Given the high hardness concentrations and mostly non-detectable dissolved copper concentrations from BHP outfall 005, this source is not expected to cause exceedances of criteria even during low flow conditions.
5. Current & Carlota (1997): The model predicted that implementation of the Carlota Copper Project (as formulated in the 1997 EIS) would decrease copper loads to the stream by 2 - 5 percent for all modeled storm events, both due to the impoundment of

drainage area and the reduction of loads from the Cactus Breccia deposit. These factors more than offset the small increase in load associated with the Main and Eder Rock Areas during the 25-year and 100-year storm events.

Dissolve copper concentrations at stations PC-200 and PC-300 were either very close to current conditions. This scenario was not different from the current conditions scenario in terms of attainment of acute or chronic dissolved copper criteria at stations PC-200 and PC-300.

6. Carlota (1997) & Gibson remediated: Results of this scenarios varied by no more than 0.2 ug/L from the results of scenario 2 (Gibson remediation) upstream of Five Point Mountain Tributary (formerly Un-named Tributary #2), and were similar to the results of scenario 2 downstream of Five Point Mountain Tributary (formerly Un-named Tributary #2). Compared to current conditions, copper loads were decreased by 51 - 55 and 43 - 55 percent at stations PC-200 and PC-300, respectively. As with scenario 2, this scenario was predicted to cause compliance with acute and chronic water quality standards at PC-300 under all modeled stormflow conditions.
7. Current & Carlota (2004): Results of this scenario were identical to those of scenario 5 [Current & Carlota (1997)] for all locations and all event above the Haunted Canyon confluence with Pinto Creek., and very similar at the remaining downstream event/locations. Compared to the 1997 scenario, dissolved copper concentrations in the Haunted Canyon reach were reduced by 1 - 2 percent for the two large storm events, due to the lack of discharge from the Main and Eder Rock areas. However, the predicted instream concentrations at PC-200 and PC-300 were very similar between the 1997 and 2004 scenarios. This is because, although the copper load decreased under the 2004 scenario, the reduced discharge under the 2004 scenario actually provided less dilution of loads from upstream sources.
8. Carlota (2004) & Gibson remediation: Results of this scenario were identical to those of scenario 6 [Carlota (1997) & Gibson remediation] for all locations and all event above the Haunted Canyon confluence with Pinto Creek, and very similar at the remaining downstream event/locations. Compared to current conditions, copper loads were decreased by 51-55 and 43-55 percent at stations PC-200 and PC-300, respectively. This scenario was predicted to cause to cause compliance with acute and chronic water quality standards at PC-300 under all modeled stormflow conditions.

SUMMARY AND CONCLUSIONS

The Pinto Creek HSPF model represents significant progress over the HEC-1 modeling approach used for the Phase I TMDL. The HSPF model is based on a much larger and more informative data set than was available for the Phase I TMDL, with better information on background loads, source loads, and concentrations experienced during storm events. Unlike the Phase I calculations, the HSPF model was calibrated to observed hydrologic and water quality data. Calibration results demonstrate that the model is capable of reproducing the pattern of stormflow peaks and dissolved copper concentrations observed in Pinto Creek.

As a rainfall-runoff model, the Pinto Creek HSPF model was primarily calibrated to storm events. Such conditions represent the critical hydrologic conditions for copper, when runoff and interflow from both natural and mining-related (e.g. Gibson mine) sources occurs. Such sources can also affect low-flow concentrations due to the infiltration of stormflows into the alluvium of Pinto Creek, with subsequent emergence in perennial reaches. The HSPF model does not simulate the full complexity of interactions between surface water, the bedrock aquifer system, and the alluvial groundwater system; nor is such a simulation practical at this time. However, Pinto Creek may be protected during low flow conditions by (1) remediation of mining-related sources, which will reduce copper loads to the alluvial groundwater system as described above; and (2) limitation of dry-weather inflows to dissolved copper concentrations that do not exceed water quality standards.

An assessment of both monitoring data and model scenario results leads to the following conclusions:

1. *The Gibson Mine is single largest source of copper loads to Pinto Creek.* The HSPF model confirmed this basic finding of the Phase I TMDL. Loads from the Gibson mine represent over 90 percent of the total copper load above PC-100. Although a portion of this load does not reach PC-300 due to in-stream losses, remediation of the Gibson mine was found to be necessary to bring PC-300 into compliance with water quality criteria.
2. *Remediation of other mining-sources is also expected to provide water quality benefits to Pinto Creek.* Although much smaller contributors than the Gibson mine, other mining-related sources such as the Henderson Ranch, Bronx, Old Highway 60, and Yo Tambien mines were predicted to have minor impacts on in-stream dissolved copper concentrations under stormflow conditions.
3. *Much of the upper Pinto Creek would exceed water quality criteria even after remediation of mining-related sources.* Despite the large potential reduction in loads and concentrations described above, the combination of elevated ($>10 \mu\text{g/L}$) background concentrations and low to moderate ($<100 \text{ mg/L}$) hardness values makes it unlikely that dissolved copper criteria will be met at PC-200 and upstream locations, even after remediation of discrete mining-related sources. It should be understood that “background/ambient” loads are reflective not only of natural, undisturbed conditions, but also of diffuse anthropogenic sources and mining-related sources that are unlikely to be remediated to pristine conditions.
4. *The Carlota Copper Project was not predicted to cause large changes in copper loads or concentrations:* This project was predicted to cause an overall reduction in copper loads

SUMMARY AND CONCLUSIONS 8

to the stream by impounding drainage area and reducing the copper loading from the Cactus Breccia to Pinto Creek. Dissolved copper concentrations at downstream locations in Pinto Creek were predicted to increase slightly (0-2 µg/L) or decrease, depending on the size of the storm event. This mixed effect was a result of the competing effects of reduced loading and reduced dilution of upstream loads. The model predicted that if the Gibson mine was remediated, implementation of the Carlota Copper Project would decrease dissolved copper concentrations at PC-200 and PC-300 for all modeled stormflow conditions. There was little difference in model results between the 1997 and 2004 versions of the Carlota scenarios.

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Land Segments of the Pinto Creek HSPF Model

A

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TABLE A-1
Pervious Land Segments of the Pinto Creek HSPF Model

PERLND (Pervious Land Segment)	Cover Type	Acreage
11	Granite	620.2
12	Schist	594.4
13	Ellis Mine	5.0
21	Granite	84.7
22	Schist	1205.0
23	Henderson Ranch Mines	5.0
32	Schist	240.5
33	Gibson	15.1
41	Granite	18.6
42	Schist	368.2
51	Granite	28.9
52	Schist	704.2
61	Granite	303.5
62	Schist	11.5
64	Alluvium	261.0
71	Granite	398.4
73	Tailings	0.4
74	Alluvium	259.7
81	Granite	1063.2
82	Schist	223.6
84	Alluvium	94.6
91	Granite	1184.2
92	Schist	4.3
93	Bronx Mine	5.0
97	Mine above Old Hwy 60	5.0
101	Granite	34.7
103	Tailings	14.5
105	Basalt	2.9
106	Cactus	9.9
107	Dacite	68.4
111	Granite	193.2
112	Schist	123.1
113	Yo Tambien Tunnel	5.0
114	Alluvium	30.1
116	Cactus	49.1
117	Dacite	183.3
118	Diabase	131.1
122	Schist	8.6
126	Cactus	12.7
127	Dacite	151.6
128	Diabase	3.3
129	Apache	2.3
133	Tailings	0.1
134	Alluvium	167.2
135	Basalt	10.9
137	Dacite	38.3

PERLND (Pervious Land Segment)	Cover Type	Acreage
143	Tailings	104.3
144	Alluvium	10.6
145	Basalt	36.8
147	Dacite	6.6
149	Apache	5.5
157	Dacite	1612.7
161	Granite	164.0
162	Schist	163.6
167	Dacite	1022.2
168	Diabase	106.7
172	Schist	3.5
177	Dacite	471.9
179	Apache	35.1
187	Dacite	4934.6
188	Diabase	664.3
189	Apache	1860.1
197	Dacite	396.1
203	Tailings	103.7
206	Cactus	18.7
207	Dacite	1075.2
208	Diabase	87.7
209	Apache	483.0
214	Alluvium	111.2
217	Dacite	739.0
218	Diabase	489.3
219	Apache	444.3
221	Granite	528.5
222	Schist	303.8
223	Tailings	378.5
224	Alluvium	272.7
225	Basalt	110.9
227	Dacite	430.1
228	Diabase	742.8
229	Apache	189.9
233	Tailings	0.1
234	Alluvium	24.7
237	Dacite	113.4
239	Apache	1.0
244	Alluvium	0.6
247	Dacite	308.3
253	Tailings	377.0
254	Alluvium	115.5
257	Dacite	282.2
258	Diabase	91.6
263	Tailings	53.4
264	Alluvium	67.2
267	Dacite	41.5
271	Granite	4889.2
274	Alluvium	462.5
277	Dacite	4640.3

PERLND (Pervious Land Segment)	Cover Type	Acreage
278	Diabase	4362.6
279	Apache	3564.4
281	Granite	4108.5
284	Alluvium	1899.7
288	Diabase	794.3
289	Apache	3289.3
294	Alluvium	48.7
297	Dacite	349.0
298	Diabase	929.9
299	Apache	429.2
301	Granite	228.5
303	Tailings	2.8
304	Alluvium	375.5
308	Diabase	253.2
309	Apache	482.3
311	Granite	491.4
314	Alluvium	333.1
319	Apache	0.2
321	Granite	147.1
323	Tailings	17.3
324	Alluvium	1357.6
327	Dacite	1173.8
329	Apache	108.1
331	Granite	23704.0
334	Alluvium	16363.5
337	Dacite	8950.7
339	Apache	3986.4
341	Granite	245.0
342	Schist	131.5
343	Tailings	33.2
344	Alluvium	147.5
345	Basalt	0.6
351	Granite	13.9
353	Tailings	222.2
354	Alluvium	22.4
355	Basalt	4.1
364	Alluvium	10.6
365	Basalt	11.3
367	Dacite	1.0
372	Schist	5.9
373	Tailings	5.5
374	Alluvium	104.3
375	Basalt	154.0

Land Segments of the Pinto Creek HSPF Model

A

Pinto Creek Phase II TMDL Modeling Report

TABLE B-1
Parameters of the Pinto Creek HSPF Model

Module	Group	Table	Parameter	Units	Initial Value	Adjusted?	Comments
PERLND	SNOW	SNOW-PARM1	LAT	deg	33	No	
			MELEV	--	--	No	Not needed
			SHADE	--	--	No	Not needed
			SNOWCF	--	1.25	No	After BASINS Technical Note 6 citing Crawford (1999)
			COVIND		4	No	After BASINS Technical Note 6; considering mountainous topography
			KMELT	in/deg/15 min	0.0011	No	Using same value as Cornell used in Canajoharie Creek model. See http://www.cfe.cornell.edu/wri/projects/pesticides/canajoharie/fr/canafinal0.html
			TBASE	deg F	32	No	default; melting temp of snow
PWATER	PWAT-PARM1	CSNOFG	--		1	No	considering snow
			RTOPFG	--	1	No	default
			UZFG	--	1	No	default
			VCSFG	--	0	No	not simulating monthly variable CEPSC
			VUZFG	--	0	No	not simulating monthly variable UZSN
			VMNFG	--	0	No	not simulating monthly variable NSUR
			VIFWFG	--	0	No	not simulating monthly variable INTFW
			VIRCFG	--	0	No	not simulating monthly variable IRC
			VLEFG	--	0	No	Not simulating monthly variable LSETP
			IFFCFG	--	1	No	default
			HWTFG	--	0	No	default
			IRRGFG	--	0	No	default
	PWAT-PARM2	FOREST	--	Variable	No		0.3 for undeveloped land, 0.0 for tailings piles
		LZSN	in		7	Yes	Increased to account for groundwater storage in alluvium
		INFILT	in/hr	Variable	Yes		Most soils are type C or D with high runoff potential. Lowered to match storm peaks.
		LSUR	ft	Variable	No		Estimated for each subbasin from inspection of DOQQ
		SLSUR	--		200	Yes	Assigned low value due to rugged topography
		KVARY	1/in		0	No	default
	PWAT-PARM3	AGWRC	1/day		0.98	Yes	Adjusted to match baseflow recession
		Initializing with default values for PETMAX, PETMIN, INFEXP, and INFILD					
		DEEPFR	--		0.2	Yes	Adjusted to match baseflows.
		BASETP	--		0	Yes	Increased to match baseflows

Module	Group	Table	Parameter	Units	Initial Value	Adjusted?	Comments
		PWAT-PARM4	AGWETP	--	0	No	No significant wetlands
			CEPSC	in	0.03	No	High proportion of bare soil
			UZSN	in	0.42	Yes	Adjusted to match storm volumes and peak timing
			NSUR	--	0.2	Yes	Adjusted to match storm peak timing.
			INTFW	--	2	No	Initialized with median of typical values given in BTN6
			IRC	--	0.5	Yes	Adjusted to match storm peak recession
			LZETP	--	0.2	No	Initializing with default value
		PWAT-PARM5	Initialized with default values for PETMAX, PETMIN, INFEXP, and INFILD				
		PWAT-PARM6	Not used because HWTFG is set to 0				
		PWAT-PARM7	Not used because HWTFG is set to 0				
	SED	SED-PARM1	CRVFG	--	0	No	SED parameters set to allow modeling of even mean concentration in runoff.
			VSIVFG	--	0	No	
			SDOPFG	--	0	No	
		SED-PARM2	SMPF	--	1	No	
			KRER	--	1	No	
			JRER	--	1	No	
			AFFIX	--	0	No	
			COVER	--	0	No	
			NVSI	--	0	No	
		SED-PARM3	KSER	--	1	No	
			JSER	--	1	No	
			KGER	--	0	No	
			JGER	--	0	No	
	PQUAL	QUAL-PROPS(1)	QUALID	Cu-D	Variable	No	
			QTYID	mg	Variable	No	using milligrams as basic mass unit
			QSDFG	--	1	No	constituent is sediment-associated
			VPFWFG	--	0	No	No monthly variable potency factor
			VPFSFG	--	0	No	No monthly variable scour
			QSOFG	--	0	No	constituent not directly associated with overland flow
			VQOFG	--	0	No	
			QIFWFG	--	1	No	constituent associated with interflow
			VIQCFG	--	0	No	no monthly variable interflow concentration
			QAGWFG	--	1	No	constituent associated with groundwater
		QUAL-INPUT(1)	VAQCFG	--	0	No	no monthly variable groundwater concentration
			SQO	--	0	No	not used
			POTFW	mg/ton	Variable	Yes	Initially determined from monitoring data, varies w/ land cover,
			POTFS	mg/ton	0	No	adjusted to calibrate in-stream concentrations.

Module	Group	Table	Parameter	Units	Initial Value	Adjusted?	Comments
			IOQC	mg/ft3	Variable	No	Initially determined from monitoring data, varies w/ land cover, adjusted to calibrate in-stream concentrations.
			AOQC	mg/ft3	Variable	No	Initially determined from monitoring data, varies w/ land cover, adjusted to calibrate in-stream concentrations.
RCHRES	HYDR	HYDR-PARM2	LEN	ft	Variable	No	Determined from topographic maps
			DELTH	ft	Variable	No	Determined from topographic maps
			STCOR	ft	0	No	Not comparing reach depth reported as stage to modeled reach stage
			KS	--	0.5	No	Initializing with default value
			DB50	in	--	No	Not used
GQUAL	GQ-QALDATA		GQID	Copper	Variable	No	
			DQAL	mg/L	0.02	No	Initial concentration
			CONCID	mg/L	Variable	No	
			CONV		0.0353	No	Conversion from HSPF units to CONCIC units
			QTYID	mg	Variable	No	
	QG-QALFG		HDRL		0	No	Modeled in-stream losses by reduction of loads passed to downstream reaches rather than setting decay/adsorption factors.
			OXID		0	No	
			PHOT		0	No	
			VOLT		0	No	
			BIOD		0	No	
			GEN		0	No	
			SDAS		0	No	

TABLE B-2
from Previous Land Segments Under Current
Conditions

PERLND	Description	Cu ($\mu\text{g/L}$)
11	Granite	11.3
12	Schist	11.3
13	Ellis Mine	11.3
21	Granite	58.6
22	Schist	33.2
23	HRM	4,000
32	Schist	33.2
33	Gibson	110,000
41	Granite	40.7
42	Schist	33.2
51	Granite	40.7
52	Schist	33.2
61	Granite	40.7
62	Schist	33.2
64	Alluvium	24.7
71	Granite	40.7
73	Tailings	100.0
74	Alluvium	24.7
81	Granite	40.7
82	Schist	33.2
84	Alluvium	24.7
91	Granite	40.7
92	Schist	33.2
93	Bronx Mine	10,000
97	Mine above old 60	10,000
101	Granite	40.7
103	Tailings	100.0
105	Basalt	18.2
106	Cactus	250.0
107	Dacite	25.2
111	Granite	40.7
112	Schist	33.2
113	Yo Tambien	100.0
114	Alluvium	24.7
116	Cactus	250.0
117	Dacite	25.2
118	Diabase	25.2
122	Schist	33.2
126	Cactus	250.0
127	Dacite	25.2
128	Diabase	25.2
129	Apache	7.2
133	Tailings	100.0
134	Alluvium	24.7

PERLND	Description	Cu (µg/L)
135	Basalt	18.2
137	Dacite	25.2
143	Tailings	100.0
144	Alluvium	24.7
145	Basalt	18.2
147	Dacite	25.2
149	Apache	7.2
157	Dacite	21.6
161	Granite	21.6
162	Schist	21.6
167	Dacite	21.6
168	Diabase	21.6
172	Schist	33.2
177	Dacite	21.6
179	Apache	7.2
187	Dacite	8.1
188	Diabase	8.1
189	Apache	8.1
197	Dacite	8.1
203	Tailings	100.0
206	Cactus	250.0
207	Dacite	25.2
208	Diabase	15.1
209	Apache	7.2
214	Alluvium	19.6
217	Dacite	19.6
218	Diabase	19.6
219	Apache	19.6
221	Granite	40.7
222	Schist	33.2
223	Tailings	100.0
224	Alluvium	24.7
225	Basalt	18.2
227	Dacite	25.2
228	Diabase	25.2
229	Apache	7.2
233	Tailings	100.0
234	Alluvium	24.7
237	Dacite	25.2
239	Apache	7.2
244	Alluvium	24.7
247	Dacite	25.2
253	Tailings	100.0
254	Alluvium	24.7
257	Dacite	25.2
258	Diabase	25.2
263	Tailings	100.0
264	Alluvium	24.7
267	Dacite	25.2

PERLND	Description	Cu (µg/L)
271	Granite	7.7
274	Alluvium	7.7
277	Dacite	7.7
278	Diabase	7.7
279	Apache	7.7
281	Granite	7.7
284	Alluvium	7.7
288	Diabase	7.7
289	Apache	7.7
294	Alluvium	24.7
297	Dacite	25.2
298	Diabase	25.2
299	Apache	7.2
301	Granite	20.8
303	Tailings	100.0
304	Alluvium	24.7
308	Diabase	25.2
309	Apache	7.2
311	Granite	20.8
314	Alluvium	24.7
319	Apache	7.2
321	Granite	20.8
323	Tailings	100.0
324	Alluvium	24.7
327	Dacite	25.2
329	Apache	7.2
331	Granite	20.8
334	Alluvium	24.7
337	Dacite	25.2
339	Apache	7.2
341	Granite	40.7
342	Schist	33.2
343	Tailings	100.0
344	Alluvium	24.7
345	Basalt	18.2
351	Granite	40.7
353	Tailings	100.0
354	Alluvium	24.7
355	Basalt	18.2
364	Alluvium	24.7
365	Basalt	18.2
367	Dacite	25.2
372	Schist	33.2
373	Tailings	100.0
374	Alluvium	24.7
375	Basalt	18.2

HSPF User's Control Input File: Pinto Creek Calibration Scenario

C

Pinto Creek Phase II TMDL Modeling Report

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

RUN

GLOBAL

UCI Created by WinHSPF for Pinto
START 2001/12/07 21:00 END 2004/03/29 14:00
RUN INTERP OUTPT LEVELS 1 0
RESUME 0 RUN 1 UNITS 1
END GLOBAL

FILES

<FILE> <UN#>***<----FILE NAME----->
MESSU 24 Pinto.ech
91 Pinto.out
WDM1 25 Pinto.wdm
WDM2 26 Meteo.wdm
END FILES

OPN SEQUENCE

INGRP INDELT 00:15

PERLND 11
PERLND 12
PERLND 13
PERLND 21
PERLND 22
PERLND 23
PERLND 32
PERLND 33
PERLND 41
PERLND 42
PERLND 51
PERLND 52
PERLND 64
PERLND 61
PERLND 62
PERLND 74
PERLND 71
PERLND 73
PERLND 84
PERLND 81
PERLND 82
PERLND 91
PERLND 92
PERLND 93
PERLND 97
PERLND 105
PERLND 106
PERLND 107

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

PERLND	101
PERLND	103
PERLND	113
PERLND	114
PERLND	116
PERLND	117
PERLND	118
PERLND	111
PERLND	112
PERLND	129
PERLND	126
PERLND	127
PERLND	128
PERLND	122
PERLND	134
PERLND	135
PERLND	137
PERLND	133
PERLND	144
PERLND	149
PERLND	145
PERLND	147
PERLND	143
PERLND	157
PERLND	167
PERLND	168
PERLND	161
PERLND	162
PERLND	179
PERLND	177
PERLND	172
PERLND	189
PERLND	187
PERLND	188
PERLND	197
PERLND	209
PERLND	206
PERLND	207
PERLND	208
PERLND	203
PERLND	214
PERLND	219
PERLND	217
PERLND	218
PERLND	224
PERLND	229
PERLND	225
PERLND	227
PERLND	228

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

PERLND	221
PERLND	222
PERLND	223
PERLND	234
PERLND	239
PERLND	237
PERLND	233
PERLND	244
PERLND	247
PERLND	254
PERLND	257
PERLND	258
PERLND	253
PERLND	264
PERLND	267
PERLND	263
PERLND	274
PERLND	279
PERLND	277
PERLND	278
PERLND	271
PERLND	284
PERLND	289
PERLND	288
PERLND	281
PERLND	294
PERLND	299
PERLND	297
PERLND	298
PERLND	304
PERLND	309
PERLND	308
PERLND	301
PERLND	303
PERLND	314
PERLND	319
PERLND	311
PERLND	324
PERLND	329
PERLND	327
PERLND	321
PERLND	323
PERLND	334
PERLND	339
PERLND	337
PERLND	331
PERLND	344
PERLND	345
PERLND	341

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```
PERLND      342
PERLND      343
PERLND      354
PERLND      355
PERLND      351
PERLND      353
PERLND      364
PERLND      365
PERLND      367
PERLND      374
PERLND      375
PERLND      372
PERLND      373
RCHRES      1
RCHRES      2
RCHRES      3
RCHRES      4
RCHRES      5
RCHRES      6
RCHRES      7
RCHRES      8
RCHRES      9
RCHRES     10
RCHRES     11
RCHRES     12
RCHRES     13
RCHRES     14
RCHRES     15
RCHRES     16
RCHRES     17
RCHRES     18
RCHRES     19
RCHRES     20
RCHRES     21
RCHRES     22
RCHRES     23
RCHRES     24
RCHRES     25
RCHRES     26
RCHRES     27
RCHRES     28
RCHRES     29
RCHRES     30
RCHRES     31
RCHRES     32
RCHRES     33
RCHRES     38
END INGRP
END OPN SEQUENCE
```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

PERLND
ACTIVITY
*** <PLS >           Active Sections          ***
*** x - x ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC ***
11 375   1   1   1   0   0   1   0   0   0   0   0   0
END ACTIVITY

PRINT-INFO
*** < PLS>           Print-flags          PIVL  PYR
*** x - x ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC
11 375   4   4   4   4   4   4   4   4   4   4   4   4   1   9
END PRINT-INFO

GEN-INFO
***          Name          Unit-systems      Printer BinaryOut
*** <PLS >          t-series        Engl Metr Engl Metr
*** x - x
          in    out
11     Granite       1     1     0     0     0     0
12     Schist        1     1     0     0     0     0
13     Mine above Simpson 1     1     0     0     0     0
21     Granite       1     1     0     0     0     0
22     Schist        1     1     0     0     0     0
23     HRM           1     1     0     0     0     0
32     Schist        1     1     0     0     0     0
33     Gibson         1     1     0     0     0     0
41     Granite       1     1     0     0     0     0
42     Schist        1     1     0     0     0     0
51     Granite       1     1     0     0     0     0
52     Schist        1     1     0     0     0     0
61     Granite       1     1     0     0     0     0
62     Schist        1     1     0     0     0     0
64     Alluvium      1     1     0     0     0     0
71     Granite       1     1     0     0     0     0
73     Tailings      1     1     0     0     0     0
74     Alluvium      1     1     0     0     0     0
81     Granite       1     1     0     0     0     0
82     Schist        1     1     0     0     0     0
84     Alluvium      1     1     0     0     0     0
91     Granite       1     1     0     0     0     0
92     Schist        1     1     0     0     0     0
93     Bronx Mine    1     1     0     0     0     0
97     Mine above old 60 1     1     0     0     0     0
101    Granite       1     1     0     0     0     0
103    Tailings      1     1     0     0     0     0
105    Basalt         1     1     0     0     0     0
106    Cactus         1     1     0     0     0     0
107    Dacite         1     1     0     0     0     0
111    Granite       1     1     0     0     0     0

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

112	Schist	1	1	0	0	0	0
113	Yo Tambien	1	1	0	0	0	0
114	Alluvium	1	1	0	0	0	0
116	Cactus	1	1	0	0	0	0
117	Dacite	1	1	0	0	0	0
118	Diabase	1	1	0	0	0	0
122	Schist	1	1	0	0	0	0
126	Cactus	1	1	0	0	0	0
127	Dacite	1	1	0	0	0	0
128	Diabase	1	1	0	0	0	0
129	Apache	1	1	0	0	0	0
133	Tailings	1	1	0	0	0	0
134	Alluvium	1	1	0	0	0	0
135	Basalt	1	1	0	0	0	0
137	Dacite	1	1	0	0	0	0
143	Tailings	1	1	0	0	0	0
144	Alluvium	1	1	0	0	0	0
145	Basalt	1	1	0	0	0	0
147	Dacite	1	1	0	0	0	0
149	Apache	1	1	0	0	0	0
157	Dacite	1	1	0	0	0	0
161	Granite	1	1	0	0	0	0
162	Schist	1	1	0	0	0	0
167	Dacite	1	1	0	0	0	0
168	Diabase	1	1	0	0	0	0
172	Schist	1	1	0	0	0	0
177	Dacite	1	1	0	0	0	0
179	Apache	1	1	0	0	0	0
187	Dacite	1	1	0	0	0	0
188	Diabase	1	1	0	0	0	0
189	Apache	1	1	0	0	0	0
197	Dacite	1	1	0	0	0	0
203	Tailings	1	1	0	0	0	0
206	Cactus	1	1	0	0	0	0
207	Dacite	1	1	0	0	0	0
208	Diabase	1	1	0	0	0	0
209	Apache	1	1	0	0	0	0
214	Alluvium	1	1	0	0	0	0
217	Dacite	1	1	0	0	0	0
218	Diabase	1	1	0	0	0	0
219	Apache	1	1	0	0	0	0
221	Granite	1	1	0	0	0	0
222	Schist	1	1	0	0	0	0
223	Tailings	1	1	0	0	0	0
224	Alluvium	1	1	0	0	0	0
225	Basalt	1	1	0	0	0	0
227	Dacite	1	1	0	0	0	0
228	Diabase	1	1	0	0	0	0
229	Apache	1	1	0	0	0	0

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

233	Tailings	1	1	0	0	0	0
234	Alluvium	1	1	0	0	0	0
237	Dacite	1	1	0	0	0	0
239	Apache	1	1	0	0	0	0
244	Alluvium	1	1	0	0	0	0
247	Dacite	1	1	0	0	0	0
253	Tailings	1	1	0	0	0	0
254	Alluvium	1	1	0	0	0	0
257	Dacite	1	1	0	0	0	0
258	Diabase	1	1	0	0	0	0
263	Tailings	1	1	0	0	0	0
264	Alluvium	1	1	0	0	0	0
267	Dacite	1	1	0	0	0	0
271	Granite	1	1	0	0	0	0
274	Alluvium	1	1	0	0	0	0
277	Dacite	1	1	0	0	0	0
278	Diabase	1	1	0	0	0	0
279	Apache	1	1	0	0	0	0
281	Granite	1	1	0	0	0	0
284	Alluvium	1	1	0	0	0	0
288	Diabase	1	1	0	0	0	0
289	Apache	1	1	0	0	0	0
294	Alluvium	1	1	0	0	0	0
297	Dacite	1	1	0	0	0	0
298	Diabase	1	1	0	0	0	0
299	Apache	1	1	0	0	0	0
301	Granite	1	1	0	0	0	0
303	Tailings	1	1	0	0	0	0
304	Alluvium	1	1	0	0	0	0
308	Diabase	1	1	0	0	0	0
309	Apache	1	1	0	0	0	0
311	Granite	1	1	0	0	0	0
314	Alluvium	1	1	0	0	0	0
319	Apache	1	1	0	0	0	0
321	Granite	1	1	0	0	0	0
323	Tailings	1	1	0	0	0	0
324	Alluvium	1	1	0	0	0	0
327	Dacite	1	1	0	0	0	0
329	Apache	1	1	0	0	0	0
331	Granite	1	1	0	0	0	0
334	Alluvium	1	1	0	0	0	0
337	Dacite	1	1	0	0	0	0
339	Apache	1	1	0	0	0	0
341	Granite	1	1	0	0	0	0
342	Schist	1	1	0	0	0	0
343	Tailings	1	1	0	0	0	0
344	Alluvium	1	1	0	0	0	0
345	Basalt	1	1	0	0	0	0
351	Granite	1	1	0	0	0	0

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

353    Tailings           1   1   0   0   0   0
354    Alluvium          1   1   0   0   0   0
355    Basalt            1   1   0   0   0   0
364    Alluvium          1   1   0   0   0   0
365    Basalt            1   1   0   0   0   0
367    Dacite             1   1   0   0   0   0
372    Schist             1   1   0   0   0   0
373    Tailings          1   1   0   0   0   0
374    Alluvium          1   1   0   0   0   0
375    Basalt            1   1   0   0   0   0
END GEN-INFO

```

ATEMP-DAT		ELDAT	AIRTEMP
*** <PLS >	*** x - x	(ft)	(deg F)
11	13	700	60
21	23	300	60
32	33	-300	60
41	42	-200	60
51	52	100	60
61	64	-700	60
71	74	-600	60
81	84	-700	60
91	97	-300	60
101	107	-1100	60
111	118	-1200	60
122	129	-1100	60
133	137	-1200	60
143	149	-1100	60
157		-400	60
161	168	-700	60
172	179	-1100	60
187	189	-300	60
197		-1000	60
203	209	-1400	60
214	219	-800	60
221	229	-1000	60
233	239	-1500	60
244	247	-1200	60
253	258	-1100	60
263	267	-1500	60
271	279	-600	60
281	289	-1100	60
294	299	0	60
301	309	-700	60
311	319	-1200	60
321	329	-1600	60
331	339	-1200	60
341	345	-1500	60

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

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351 355      -900      60
364 375      -1000      60
END ATEMP-DAT

SNOW-FLAGS
*** <PLS >
*** x - x SNOP  VKM
 11 375   1   0
END SNOW-FLAGS

SNOW-PARM1
*** < PLS>          LAT      MELEV      SHADE      SNOWCF      COVIND      KMELT      TBASE
*** x - x degrees    (ft)           (in)       (in/d.F)     (in/d.F)     (F)
 11 375      33.5      0.        0.3        1.2        4.        0.0011      32.
END SNOW-PARM1

PWAT-PARM1
*** <PLS >          Flags
*** x - x CSNO RTOP UZFG  VCS  VUZ  VNN  VIFW  VIRC  VLE  IFFC  HWT  IRRG
 11 375   1   1      1   1   0   0   0   0   1   1   0   0
END PWAT-PARM1

PWAT-PARM2
*** < PLS>          FOREST    LZSN      INFILT      LSUR      SLSUR      KVARY      AGWRC
*** x - x             (in)       (in/hr)     (ft)           (1/in)     (1/day)
 11 13      0.3        6.        0.15        200.      0.1479      0.        0.99
 21 23      0.3        6.        0.15        200.      0.0838      0.        0.99
 32          0.3        6.        0.12        200.      0.0621      0.        0.99
 33          0.          6.        0.12        200.      0.0621      0.        0.99
 41 42      0.3        6.        0.25        200.      0.1133      0.        0.98
 51 52      0.3        6.        0.25        200.      0.0784      0.        0.98
 61 64      0.3        6.        0.15        200.      0.1475      0.        0.98
 71          0.3        6.        0.15        200.      0.1175      0.        0.98
 73          0.          6.        0.15        200.      0.1175      0.        0.98
 74          0.3        6.        0.15        200.      0.1175      0.        0.98
 81 84      0.3        6.        0.15        200.      0.1529      0.        0.98
 91 97      0.3        6.        0.15        200.      0.1225      0.        0.98
101          0.3        6.        0.15        200.      0.0935      0.        0.98
103          0.          6.        0.15        200.      0.0935      0.        0.98
105 107     0.3        6.        0.15        200.      0.0935      0.        0.98
111 118     0.3        6.        0.15        200.      0.1587      0.        0.98
122 129     0.3        6.        0.15        200.      0.1522      0.        0.98
133          0.          6.        0.15        200.      0.0878      0.        0.98
134 137     0.3        6.        0.15        200.      0.0878      0.        0.98
143          0.          6.        0.15        200.      0.1062      0.        0.98
144 149     0.3        6.        0.15        200.      0.1062      0.        0.98
157          0.3        6.        0.15        200.      0.189       0.        0.98
161 168     0.3        6.        0.15        200.      0.1872      0.        0.98
172 179     0.3        6.        0.15        200.      0.1913      0.        0.98

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187 189      0.3      6.      0.15     200.     0.258      0.      0.98
197          0.3      6.      0.15     200.     0.2268     0.      0.98
203          0.       6.      0.15     200.     0.208      0.      0.98
206 209      0.3      6.      0.15     200.     0.208      0.      0.98
214 219      0.3     100.     0.01     100.     0.204      0.      0.98
221 222      0.3     100.     0.01     100.     0.2065     0.      0.98
223          0.     100.     0.01     100.     0.2065     0.      0.98
224 229      0.3     100.     0.01     100.     0.2065     0.      0.98
233          0.     100.     0.01     100.     0.1753     0.      0.98
234 239      0.3     100.     0.01     100.     0.1753     0.      0.98
244 247      0.3     100.     0.01     100.     0.1914     0.      0.98
253          0.     100.     0.01     100.     0.163      0.      0.98
254 258      0.3     100.     0.01     100.     0.163      0.      0.98
263          0.     100.     0.01     100.     0.0945     0.      0.98
264 267      0.3     100.     0.01     100.     0.0945     0.      0.98
271 279      0.3     100.     0.01     100.     0.2344     0.      0.98
281 289      0.3     100.     0.01     100.     0.1806     0.      0.98
294 299      0.3     100.     0.01     100.     0.2763     0.      0.98
301          0.3     100.     0.01     100.     0.2337     0.      0.98
303          0.     100.     0.01     100.     0.2337     0.      0.98
304 309      0.3     100.     0.01     100.     0.2337     0.      0.98
311 319      0.3     100.     0.01     100.     0.1836     0.      0.98
321          0.3     100.     0.01     100.     0.1417     0.      0.98
323          0.     100.     0.01     100.     0.1417     0.      0.98
324 329      0.3     100.     0.01     100.     0.1417     0.      0.98
331 339      0.3     100.     0.25      100.     0.1778     0.      0.98
341 342      0.3     100.     0.01     100.     0.1541     0.      0.98
343          0.     100.     0.01     100.     0.1541     0.      0.98
344 345      0.3     100.     0.01     100.     0.1541     0.      0.98
351          0.3     100.     0.01     100.     0.0824     0.      0.98
353          0.     100.     0.01     100.     0.0824     0.      0.98
354 355      0.3     100.     0.01     100.     0.0824     0.      0.98
364 367      0.3     100.     0.01     100.     0.0743     0.      0.98
372          0.3     100.     0.01     100.     0.1427     0.      0.98
373          0.     100.     0.01     100.     0.1427     0.      0.98
374 375      0.3     100.     0.01     100.     0.1427     0.      0.98

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END PWAT-PARM2

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PWAT-PARM3
*** < PLS>    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
*** x - x (deg F) (deg F)
   11  33        40.       35.       2.         2.         1.         0.02       0.
   41  97        40.       35.       2.         2.         1.         0.05       0.
  101 209        40.       35.       2.         2.         0.7        0.05       0.
  214 329        40.       35.       2.         2.         0.7        0.025      0.
  331 339        40.       35.       2.         2.         0.7        0.015      0.
  341 375        40.       35.       2.         2.         1.         0.015      0.

```

END PWAT-PARM3

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

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PWAT-PARM4
*** <PLS>      CEPSC      UZSN      NSUR      INTFW      IRC      LZETP
*** x - x        (in)       (in)      0.2       1.        0.5      0.7
    11 209        0.03      0.08
    214 375       0.03      0.3       0.05      1.        0.2      0.3
END PWAT-PARM4

PWAT-PARM5
*** <PLS>      FZG        FZGL
*** x - x
    11 375       1.        0.1
END PWAT-PARM5

PWAT-PARM6
*** <PLS>      MELEV      BELV      GWDATM     PCW       PGW       UPGW
*** x - x        (ft)       (ft)      (ft)      0.01      0.01      0.01
    11 375       0.          1.        1.
END PWAT-PARM6

PWAT-PARM7
*** <PLS>      STABNO     SRRC      SREXP      IFWSC      DELTA     UELFAC     LELFAC
*** x - x        (/hr)     (in)      (in)      0.001     4.        2.5
    11 375       0.          0.1      1.          1.
END PWAT-PARM7

PWAT-STATE1
*** <PLS>      PWATER state variables (in)
*** x - x        CEPS       SURS      UZS       IFWS       LZS       AGWS       GWVS
    11 375       0.01      0.01      0.3       0.01      1.5       0.01      0.01
END PWAT-STATE1

MON-INTERCEP
*** <PLS>      Interception storage capacity at start of each month (in)
*** x - x        JAN   FEB   MAR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC
    11 375       0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1   0.1
END MON-INTERCEP

MON-LZETPARM
*** <PLS>      Lower zone evapotransp      parm at start of each month
*** x - x        JAN   FEB   MAR   APR   MAY   JUN   JUL   AUG   SEP   OCT   NOV   DEC
    11 375       0.2   0.2   0.3   0.3   0.4   0.4   0.4   0.4   0.4   0.4   0.3   0.2
END MON-LZETPARM

SED-PARM1
*** <PLS>      Sediment parameters 1
*** x - x        CRV  VSIV  SDOP
    11 375       0     0     0
END SED-PARM1

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USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

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SED-PARM2
*** <PLS >      SMPF       KRER       JRER       AFFIX       COVER       NVSI
*** x - x          1.         1.         1.         (/day)      0.          lb/ac-day
11   375           1.         1.         1.         0.          0.          0.
END SED-PARM2

SED-PARM3
*** <PLS >  Sediment parameter 3
*** x - x      KSER       JSER       KGER       JGER
11   375           1.         1.         0.         0.
END SED-PARM3

MON-COVER
*** <PLS >  Monthly values for erosion related cover
*** x - x    JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC
11   375  0.85 0.85 0.85 0.9  0.95 0.95 0.95 0.95 0.95 0.95 0.85 0.85
END MON-COVER

SED-STOR
*** <PLS >  Detached sediment storage (tons/acre)
*** x - x      DETS
11   375           0.05
END SED-STOR

NQUALS
*** <PLS >
*** x - xNQUAL
11   375           1
END NQUALS

QUAL-PROPS
*** <PLS >  Identifiers and Flags
*** x - x      QUALID      QTID      QSD      VPFW      VPFS      QSO      VQO      QIFW      VIQC      QAGW      VAQC
11   375COPPER     mg        1        0        0        0        0        0        1        0        1        0
END QUAL-PROPS

QUAL-INPUT
***               Storage on surface and nonseasonal parameters
***             SQO      POTFW      POTFS      ACQOP      SQOLIM      WSQOP      IOQC      AOQC
*** <PLS >  qty/ac  qty/ton  qty/ton      qty/      qty/ac      in/hr  qty/ft3  qty/ft3
*** x - x
11                 0      1130       0      0.000001    1.64     0.311    0.311
12                 0      1130       0      0.000001    1.64     0.311    0.311
13                 0      1130       0      0.000001    1.64     0.311    0.311
21                 0      5861       0      0.000001    1.64     1.61     1.61
22                 0      3317       0      0.000001    1.64     0.911    0.911
23                 0      400000     0      0.000001    1.64     68.6     68.6
32                 0      3317       0      0.000001    1.64     0.911    0.911
33                 0      1.1E+07    0      0.000001    1.64     2637    2637

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USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

41		0	4069	0	00.000001	1.64	1.118	1.118
42		0	3317	0	00.000001	1.64	0.911	0.911
51		0	4069	0	00.000001	1.64	1.118	1.118
52		0	3317	0	00.000001	1.64	0.911	0.911
61		0	4069	0	00.000001	1.64	1.118	1.118
62		0	3317	0	00.000001	1.64	0.911	0.911
64		0	2472	0	00.000001	1.64	0.679	0.679
71		0	4069	0	00.000001	1.64	1.118	1.118
73		0	10000	0	00.000001	1.64	1.4	1.4
74		0	2472	0	00.000001	1.64	0.679	0.679
81		0	4069	0	00.000001	1.64	1.118	1.118
82		0	3317	0	00.000001	1.64	0.911	0.911
84		0	2472	0	00.000001	1.64	0.679	0.679
91		0	4069	0	00.000001	1.64	1.118	1.118
92		0	3317	0	00.000001	1.64	0.911	0.911
93	97	0	1000000	0	00.000001	1.64	275	275
101		0	4069	0	00.000001	1.64	1.118	1.118
103		0	10000	0	00.000001	1.64	1.4	1.4
105		0	1823	0	00.000001	1.64	0.502	0.502
106		0	25000	0	00.000001	1.64	7	7
107		0	2518	0	00.000001	1.64	0.694	0.694
111		0	4069	0	00.000001	1.64	1.118	1.118
112		0	3317	0	00.000001	1.64	0.911	0.911
113		0	10000	0	00.000001	1.64	1.4	1.4
114		0	2472	0	00.000001	1.64	0.679	0.679
116		0	25000	0	00.000001	1.64	7	7
117	118	0	2518	0	00.000001	1.64	0.694	0.694
122		0	3317	0	00.000001	1.64	0.911	0.911
126		0	25000	0	00.000001	1.64	7	7
127	128	0	2518	0	00.000001	1.64	0.694	0.694
129		0	720	0	00.000001	1.64	0.198	0.198
133		0	10000	0	00.000001	1.64	1.4	1.4
134		0	2472	0	00.000001	1.64	0.679	0.679
135		0	1823	0	00.000001	1.64	0.502	0.502
137		0	2518	0	00.000001	1.64	0.694	0.694
143		0	10000	0	00.000001	1.64	1.4	1.4
144		0	2472	0	00.000001	1.64	0.679	0.679
145		0	1823	0	00.000001	1.64	0.502	0.502
147		0	2518	0	00.000001	1.64	0.694	0.694
149		0	720	0	00.000001	1.64	0.198	0.198
157		0	2163	0	00.000001	1.64	0.594	0.594
161		0	2163	0	00.000001	1.64	0.594	0.594
162		0	2163	0	00.000001	1.64	0.594	0.594
167	168	0	2163	0	00.000001	1.64	0.594	0.594
172		0	3317	0	00.000001	1.64	0.911	0.911
177		0	2163	0	00.000001	1.64	0.594	0.594
179		0	720	0	00.000001	1.64	0.198	0.198
187	188	0	814	0	00.000001	1.64	0.224	0.224
189		0	814	0	00.000001	1.64	0.224	0.224

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

197	0	814	0	00.000001	1.64	0.224	0.224	
203	0	10000	0	00.000001	1.64	1.4	1.4	
206	0	25000	0	00.000001	1.64	7	7	
207	0	2518	0	00.000001	1.64	0.425	0.425	
208	0	1514	0	00.000001	1.64	0.425	0.425	
209	0	720	0	00.000001	1.64	0.198	0.198	
214	0	1957	0	00.000001	1.64	0.538	0.538	
217	218	0	1957	0	00.000001	1.64	0.538	0.538
219	0	1957	0	00.000001	1.64	0.538	0.538	
221	0	4069	0	00.000001	1.64	1.118	1.118	
222	0	3317	0	00.000001	1.64	0.911	0.911	
223	0	10000	0	00.000001	1.64	1.4	1.4	
224	0	2472	0	00.000001	1.64	0.679	0.679	
225	0	1823	0	00.000001	1.64	0.502	0.502	
227	228	0	2518	0	00.000001	1.64	0.694	0.694
229	0	720	0	00.000001	1.64	0.198	0.198	
233	0	10000	0	00.000001	1.64	1.4	1.4	
234	0	2472	0	00.000001	1.64	0.679	0.679	
237	0	2518	0	00.000001	1.64	0.694	0.694	
239	0	720	0	00.000001	1.64	0.198	0.198	
244	0	2472	0	00.000001	1.64	0.679	0.679	
247	0	2518	0	00.000001	1.64	0.694	0.694	
253	0	10000	0	00.000001	1.64	1.4	1.4	
254	0	2472	0	00.000001	1.64	0.679	0.679	
257	258	0	2518	0	00.000001	1.64	0.694	0.694
263	0	10000	0	00.000001	1.64	1.4	1.4	
264	0	2472	0	00.000001	1.64	0.679	0.679	
267	0	2518	0	00.000001	1.64	0.694	0.694	
271	0	772	0	00.000001	1.64	0.212	0.212	
274	0	772	0	00.000001	1.64	0.212	0.212	
277	278	0	772	0	00.000001	1.64	0.212	0.212
279	0	772	0	00.000001	1.64	0.212	0.212	
281	0	772	0	00.000001	1.64	0.212	0.212	
284	0	772	0	00.000001	1.64	0.212	0.212	
288	0	772	0	00.000001	1.64	0.212	0.212	
289	0	772	0	00.000001	1.64	0.212	0.212	
294	0	2472	0	00.000001	1.64	0.679	0.679	
297	298	0	2518	0	00.000001	1.64	0.694	0.694
299	0	720	0	00.000001	1.64	0.198	0.198	
301	0	2081	0	00.000001	1.64	0.573	0.573	
303	0	10000	0	00.000001	1.64	1.4	1.4	
304	0	2472	0	00.000001	1.64	0.679	0.679	
308	0	2518	0	00.000001	1.64	0.694	0.694	
309	0	720	0	00.000001	1.64	0.198	0.198	
311	0	2081	0	00.000001	1.64	0.573	0.573	
314	0	2472	0	00.000001	1.64	0.679	0.679	
319	0	720	0	00.000001	1.64	0.198	0.198	
321	0	2081	0	00.000001	1.64	0.573	0.573	
323	0	10000	0	00.000001	1.64	1.4	1.4	

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324      0    2472      0    00.000001   1.64   0.679   0.679
327      0    2518      0    00.000001   1.64   0.694   0.694
329      0    720       0    00.000001   1.64   0.198   0.198
331      0    2081      0    00.000001   1.64   0.573   0.573
334      0    2471      0    00.000001   1.64   0.679   0.679
337      0    2518      0    00.000001   1.64   0.694   0.694
339      0    772       0    00.000001   1.64   0.212   0.212
341      0    4069      0    00.000001   1.64   1.118   1.118
342      0    3317      0    00.000001   1.64   0.911   0.911
343      0    10000     0    00.000001   1.64   1.4     1.4
344      0    2472      0    00.000001   1.64   0.679   0.679
345      0    1823      0    00.000001   1.64   0.502   0.502
351      0    4069      0    00.000001   1.64   1.118   1.118
353      0    10000     0    00.000001   1.64   1.4     1.4
354      0    2472      0    00.000001   1.64   0.679   0.679
355      0    1823      0    00.000001   1.64   0.502   0.502
364      0    2472      0    00.000001   1.64   0.679   0.679
365      0    1823      0    00.000001   1.64   0.502   0.502
367      0    2518      0    00.000001   1.64   0.694   0.694
372      0    3317      0    00.000001   1.64   0.911   0.911
373      0    10000     0    00.000001   1.64   1.4     1.4
374      0    2472      0    00.000001   1.64   0.679   0.679
375      0    1823      0    00.000001   1.64   0.502   0.502

END QUAL-INPUT

MON-IFLW-CONC
*** <PLS > Conc of QUAL in interflow outflow for each month (qty/ft3)
*** x - x JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
 11 3750.0010.0010.0010.0010.0010.0010.0010.0010.0010.0010.001
END MON-IFLW-CONC

MON-GRND-CONC
*** <PLS > Value at start of month for conc of QUAL in groundwater (qty/ft3)
*** x - x JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
 11 3750.0010.0010.0010.0010.0010.0010.0010.0010.0010.0010.001
END MON-GRND-CONC

QUAL-PROPS
*** <PLS > Identifiers and Flags
*** x - x QUALID      QTID  QSD  VPFW  VPFS  QSO   VQO  QIFW  VIQC  QAGW  VAQC
 11 375HARD           mg      1     0     0     0     0     0     1     0     1     0
END QUAL-PROPS

QUAL-INPUT
*** Storage on surface and nonseasonal parameters
*** SQO  POTFW  POTFS  ACQOP  SQOLIM  WSQOP  IOQC  AOQC
*** <PLS > qty/ac qty/ton qty/ton   qty/ ac     in/hr qty/ft3 qty/ft3
*** x - x                  ac.day
 11          0.5500000.      0.        0.000001   1.64   1500.   1500.


```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

12		0.6000000.	0.	0.0.000001	1.64	1800.	1800.
13	21	0.5500000.	0.	0.0.000001	1.64	1500.	1500.
22		0.6000000.	0.	0.0.000001	1.64	1500.	1500.
23		0. 1E+07	0.	0.0.000001	1.64	7000.	7000.
32	33	0.2800000.	0.	0.0.000001	1.64	1500.	1500.
41		0.5900000.	0.	0.0.000001	1.64	1636.	1636.
42		0. 1.4E+07	0.	0.0.000001	1.64	3771.	3771.
51		0.5900000.	0.	0.0.000001	1.64	1636.	1636.
52		0. 1.4E+07	0.	0.0.000001	1.64	3771.	3771.
61		0.5900000.	0.	0.0.000001	1.64	1636.	1636.
62		0. 1.4E+07	0.	0.0.000001	1.64	3771.	3771.
64		0.5000000.	0.	0.0.000001	1.64	1388.	1388.
71		0.5900000.	0.	0.0.000001	1.64	1636.	1636.
73		0.2800000.	0.	0.0.000001	1.64	1636.	1636.
74		0.5000000.	0.	0.0.000001	1.64	1388.	1388.
81		0.5900000.	0.	0.0.000001	1.64	1636.	1636.
82		0. 1.4E+07	0.	0.0.000001	1.64	3771.	3771.
84		0.5000000.	0.	0.0.000001	1.64	1388.	1388.
91		0.4000000.	0.	0.0.000001	1.64	800.	800.
92		0. 1.6E+07	0.	0.0.000001	1.64	2000.	2000.
93	97	0.4000000.	0.	0.0.000001	1.64	1000.	1000.
101		0.5900000.	0.	0.0.000001	1.64	1636.	1636.
103		0.2800000.	0.	0.0.000001	1.64	0.	0.
105		0. 1.4E+07	0.	0.0.000001	1.64	3771.	3771.
106		0. 1E+08	0.	0.0.000001	1.64	28000.	28000.
107		0.5000000.	0.	0.0.000001	1.64	1388.	1388.
111	118	0. 1E+08	0.	0.0.000001	1.64	28000.	28000.
122		0. 1.4E+07	0.	0.0.000001	1.64	3771.	3771.
126		0. 1E+08	0.	0.0.000001	1.64	28000.	28000.
127	128	0.5000000.	0.	0.0.000001	1.64	1388.	1388.
129		0. 8.2E+07	0.	0.0.000001	1.64	22656.	22656.
133		0. 5E+07	0.	0.0.000001	1.64	1500.	1500.
134		0.5000000.	0.	0.0.000001	1.64	1388.	1388.
135		0. 1.4E+07	0.	0.0.000001	1.64	3771.	3771.
137		0.5000000.	0.	0.0.000001	1.64	1388.	1388.
143		0. 0.001	0.	0.0.000001	1.64	1500.	1500.
144		0.5000000.	0.	0.0.000001	1.64	1388.	1388.
145		0. 1.4E+07	0.	0.0.000001	1.64	3771.	3771.
147		0.5000000.	0.	0.0.000001	1.64	1388.	1388.
149		0. 8.2E+07	0.	0.0.000001	1.64	22656.	22656.
157		0.5000000.	0.	0.0.000001	1.64	1388.	1388.
161		0.5900000.	0.	0.0.000001	1.64	1636.	1636.
162		0. 1.4E+07	0.	0.0.000001	1.64	3771.	3771.
167	168	0.5000000.	0.	0.0.000001	1.64	1388.	1388.
172		0. 1.4E+07	0.	0.0.000001	1.64	3771.	3771.
177		0.5000000.	0.	0.0.000001	1.64	1388.	1388.
179		0. 8.2E+07	0.	0.0.000001	1.64	22656.	22656.
187	188	0. 1.4E+07	0.	0.0.000001	1.64	4000.	4000.
189		0. 8.2E+07	0.	0.0.000001	1.64	22656.	22656.

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

197		0.	1.4E+07	0.	0.0.000001	1.64	4000.	4000.
203		0.2800000.		0.	0.0.000001	1.64	1500.	1500.
206		0.	1E+08	0.	0.0.000001	1.64	28000.	28000.
207	208	0.	1.4E+07	0.	0.0.000001	1.64	4000.	4000.
209		0.	8.2E+07	0.	0.0.000001	1.64	22656.	22656.
214	218	0.5000000.		0.	0.0.000001	1.64	1388.	1388.
219		0.	8.2E+07	0.	0.0.000001	1.64	22656.	22656.
221		0.5900000.		0.	0.0.000001	1.64	1636.	1636.
222		0.	1.4E+07	0.	0.0.000001	1.64	3771.	3771.
223		0.	0.001	0.	0.0.000001	1.64	1500.	1500.
224		0.5000000.		0.	0.0.000001	1.64	22656.	22656.
225		0.	1.4E+07	0.	0.0.000001	1.64	3771.	3771.
227	228	0.5000000.		0.	0.0.000001	1.64	1388.	1388.
229		0.	8.2E+07	0.	0.0.000001	1.64	22656.	22656.
233		0.	0.001	0.	0.0.000001	1.64	1500.	1500.
234	237	0.5000000.		0.	0.0.000001	1.64	1388.	1388.
239		0.	8.2E+07	0.	0.0.000001	1.64	22656.	22656.
244	247	0.5000000.		0.	0.0.000001	1.64	1388.	1388.
253		0.	0.001	0.	0.0.000001	1.64	1500.	1500.
254	258	0.5000000.		0.	0.0.000001	1.64	1388.	1388.
263		0.	0.001	0.	0.0.000001	1.64	1500.	1500.
264	267	0.5000000.		0.	0.0.000001	1.64	1388.	1388.
271		0.5900000.		0.	0.0.000001	1.64	1636.	1636.
274	278	0.5000000.		0.	0.0.000001	1.64	1388.	1388.
279		0.	8.2E+07	0.	0.0.000001	1.64	22656.	22656.
281		0.5900000.		0.	0.0.000001	1.64	1636.	1636.
284	288	0.5000000.		0.	0.0.000001	1.64	1388.	1388.
289		0.	8.2E+07	0.	0.0.000001	1.64	22656.	22656.
294	298	0.5000000.		0.	0.0.000001	1.64	1388.	1388.
299		0.	8.2E+07	0.	0.0.000001	1.64	22656.	22656.
301		0.5900000.		0.	0.0.000001	1.64	1636.	1636.
303		0.	0.001	0.	0.0.000001	1.64	1500.	1500.
304	308	0.5000000.		0.	0.0.000001	1.64	1388.	1388.
309		0.	8.2E+07	0.	0.0.000001	1.64	22656.	22656.
311		0.5900000.		0.	0.0.000001	1.64	1636.	1636.
314		0.5000000.		0.	0.0.000001	1.64	1388.	1388.
319		0.	8.2E+07	0.	0.0.000001	1.64	22656.	22656.
321		0.5900000.		0.	0.0.000001	1.64	1636.	1636.
323		0.	0.001	0.	0.0.000001	1.64	1500.	1500.
324	327	0.5000000.		0.	0.0.000001	1.64	1388.	1388.
329		0.	8.2E+07	0.	0.0.000001	1.64	22656.	22656.
331		0.5900000.		0.	0.0.000001	1.64	1636.	1636.
334	337	0.5000000.		0.	0.0.000001	1.64	1388.	1388.
339		0.	8.2E+07	0.	0.0.000001	1.64	22656.	22656.
341		0.5900000.		0.	0.0.000001	1.64	1636.	1636.
342		0.	1.4E+07	0.	0.0.000001	1.64	3771.	3771.
343		0.	0.001	0.	0.0.000001	1.64	1500.	1500.
344		0.5000000.		0.	0.0.000001	1.64	1388.	1388.
345		0.	1.4E+07	0.	0.0.000001	1.64	3771.	3771.

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

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351      0.5900000.    0.    0.0.000001    1.64    1636.    1636.
353      0.    0.001    0.    0.0.000001    1.64    1500.    1500.
354      0.5000000.    0.    0.0.000001    1.64    1388.    1388.
355      0.    1.4E+07    0.    0.0.000001    1.64    3771.    3771.
364      0.5000000.    0.    0.0.000001    1.64    1388.    1388.
365      0.    1.4E+07    0.    0.0.000001    1.64    3771.    3771.
367      0.5000000.    0.    0.0.000001    1.64    1388.    1388.
372      0.    1.4E+07    0.    0.0.000001    1.64    3771.    3771.
373      0.    0.001    0.    0.0.000001    1.64    1500.    1500.
374      0.5000000.    0.    0.0.000001    1.64    1388.    1388.
375      0.    1.4E+07    0.    0.0.000001    1.64    3771.    3771.

END QUAL-INPUT

MON-IFLW-CONC
*** <PLS > Conc of QUAL in interflow outflow for each month (qty/ft3)
*** x - x JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
   11 3750.0010.0010.0010.0010.0010.0010.0010.0010.0010.0010.001
END MON-IFLW-CONC

MON-GRND-CONC
*** <PLS > Value at start of month for conc of QUAL in groundwater (qty/ft3)
*** x - x JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
   11 3750.0010.0010.0010.0010.0010.0010.0010.0010.0010.0010.001
END MON-GRND-CONC

END PERLND

RCHRES
ACTIVITY
*** RCHRES Active sections
*** x - x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG
   1   38     1     1     0     1     1     1     0     0     0     0
END ACTIVITY

PRINT-INFO
*** RCHRES Printout level flags
*** x - x HYDR ADCA CONS HEAT SED GQL OXRX NUTR PLNK PHCB PIVL PYR
   1   38     4     4     4     4     4     4     4     4     4     1     9
END PRINT-INFO

GEN-INFO
***          Name      Nexits     Unit Systems      Printer
*** RCHRES                               t-series      Engl Metr LKFG
*** x - x                                     in   out
   1     Pinto 7      1       1     91     0     0     0     0
   2     Pinto 6      1       1     91     0     0     0     0
   3     Gibson       1       1     91     0     0     0     0
   4     Unnamed Tributary 1  1       1     91     0     0     0     0
   5     Mead Canyon   1       1     91     0     0     0     0

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

6      Unnamed Tributary 5      1      1      91      0      0      0      0      0
7      BHP NPDES Outfall      1      1      91      0      0      0      0      0
8      Pinto 5                 2      1      1      91      0      0      0      0      0
9      Unnamed Tributary 2      1      1      91      0      0      0      0      0
10     Lower Cotton Wood      1      1      1      91      0      0      0      0      0
11     Pinto 4                 2      1      1      91      0      0      0      0      0
12     Grizzly Mountain       1      1      1      91      0      0      0      0      0
13     Miller Spring          1      1      1      91      0      0      0      0      0
14     Unnamed Tailings        1      1      1      91      0      0      0      0      0
15     Powers Gulch Tributa  1      1      1      91      0      0      0      0      0
16     Powers Gulch           1      1      1      91      0      0      0      0      0
17     Lower Powers Gulch    1      1      1      91      0      0      0      0      0
18     Haunted Canyon         1      1      1      91      0      0      0      0      0
19     Lower Haunted Canyon   1      1      1      91      0      0      0      0      0
20     Pinto 3                 2      1      1      91      0      0      0      0      0
21     Mowing Machine Basin   1      1      1      91      0      0      0      0      0
22     Upper Gold Gulch       1      1      1      91      0      0      0      0      0
23     Lower Gold Gulch       1      1      1      91      0      0      0      0      0
24     Unnamed Tributary 4     1      1      1      91      0      0      0      0      0
25     Middle Eastwater Can   1      1      1      91      0      0      0      0      0
26     Lower Eastwater Cany   1      1      1      91      0      0      0      0      0
27     West Fork Lower        1      1      1      91      0      0      0      0      0
28     Horrell Creek Lower    1      1      1      91      0      0      0      0      0
29     Upper Eastwater Cany   1      1      1      91      0      0      0      0      0
30     Lower Ripper Springs   1      1      1      91      0      0      0      0      0
31     Unnamed Tributary 3     1      1      1      91      0      0      0      0      0
32     Pinto 2                 2      1      1      91      0      0      0      0      0
33     Pinto 1                 1      1      1      91      0      0      0      0      0
38     Out of Basin           1      1      1      91      0      0      0      0      0

```

END GEN-INFO

HYDR-PARM1

Flags for HYDR section											
***RC	HRES	VC	A1	A2	A3	ODFVFG	for each	***ODGTFG	for each	FUNCT	for each
*** x	- x	FG	FG	FG	FG	possible	exit	*** possible	exit	possible	exit
1	7	0	1	1	1	4	0	0	0	0	0
8		0	1	1	1	4	5	0	0	0	0
9	10	0	1	1	1	4	0	0	0	0	0
11		0	1	1	1	4	5	0	0	0	0
12	19	0	1	1	1	4	0	0	0	0	0
20		0	1	1	1	4	5	0	0	0	0
21	31	0	1	1	1	4	0	0	0	0	0
32		0	1	1	1	4	5	0	0	0	0
33	38	0	1	1	1	4	0	0	0	0	0

END HYDR-PARM1

HYDR-PARM2

*** RCHRES	FTBW	FTBU	LEN	DELTH	STCOR	KS	DB50
*** x - x			(miles)	(ft)	(ft)		(in)

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

1      0.    1.    2.3292    1001.     3.2     0.5     0.01
2      0.    2.    3.3777    548.      3.2     0.5     0.01
3      0.    3.    0.8829    207.      3.2     0.5     0.01
4      0.    4.    1.2777    577.      3.2     0.5     0.01
5      0.    5.    2.3744    545.      3.2     0.5     0.01
6      0.    6.    0.86      138.      3.2     0.5     0.01
7      0.    7.    0.7244    194.      3.2     0.5     0.01
8      0.    8.    4.2344    761.      3.2     0.5     0.01
9      0.    9.    2.951     1178.     3.2     0.5     0.01
10     0.   10.    0.4831    249.      3.2     0.5     0.01
11     0.   11.    1.7873    203.      3.2     0.5     0.01
12     0.   12.    0.5985    285.      3.2     0.5     0.01
13     0.   13.    0.8278    256.      3.2     0.5     0.01
14     0.   14.    0.2448     3.        3.2     0.5     0.01
15     0.   15.    1.5166    853.      3.2     0.5     0.01
16     0.   16.    2.503     883.      3.2     0.5     0.01
17     0.   17.    1.0499    223.      3.2     0.5     0.01
18     0.   18.    4.7464    692.      3.2     0.5     0.01
19     0.   19.    0.6865     36.       3.2     0.5     0.01
20     0.   20.    3.2859    427.      3.2     0.5     0.01
21     0.   21.    2.7418    860.      3.2     0.5     0.01
22     0.   22.    1.7746    361.      3.2     0.5     0.01
23     0.   23.    0.5916    207.      3.2     0.5     0.01
24     0.   24.    1.633     1053.     3.2     0.5     0.01
25     0.   25.    1.9291    538.      3.2     0.5     0.01
26     0.   26.    0.6288    272.      3.2     0.5     0.01
27     0.   27.    8.9454    1401.     3.2     0.5     0.01
28     0.   28.    4.3788    686.      3.2     0.5     0.01
29     0.   29.    1.616     1204.     3.2     0.5     0.01
30     0.   30.    3.0024    2267.     3.2     0.5     0.01
31     0.   31.    1.6807    883.      3.2     0.5     0.01
32     0.   32.    4.8623    384.      3.2     0.5     0.01
33     0.   33.   13.2605    899.      3.2     0.5     0.01
38     0.   38.   13.2605    899.      3.2     0.5     0.01

END HYDR-PARM2

MON-CONVF
*** RCHRES Monthly f(VOL) adjustment factors
*** X - X JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
   1   38 0.97 0.89 0.89 0.91 0.93 0.93 0.94 0.95 0.95 0.98 0.98 0.97
END MON-CONVF

HYDR-INIT
***          Initial conditions for HYDR section
***RC HRES      VOL CAT Initial value of COLIND      initial value of OUTDGT
*** x - x      ac-ft      for each possible exit for each possible exit,ft3
   1   38       0.01       4.2  4.5  4.5  4.5  4.2           2.1  1.2  0.5  1.2  1.8
END HYDR-INIT

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

SANDFG
*** RCHRES
*** x - x SNDFG
    1    38    3
END SANDFG

SED-GENPARM
*** RCHRES      BEDWID     BEDWRN      POR
*** x - x      (ft)       (ft)        POR
    1    38      50.        4.         0.4
END SED-GENPARM

SAND-PM
*** RCHRES      D          W          RHO      KSAND      EXPSND
*** x - x      (in)      (in/sec)   (gm/cm3)
    1    38      0.005     0.02       2.5       0.03       5.
END SAND-PM

SILT-CLAY-PM
*** RCHRES      D          W          RHO      TAUCD      TAUCS      M
*** x - x      (in)      (in/sec)   gm/cm3    lb/ft2     lb/ft2    lb/ft2.d
    1    38      0.0004    0.0001     2.2       0.1       0.32      0.005
END SILT-CLAY-PM

SILT-CLAY-PM
*** RCHRES      D          W          RHO      TAUCD      TAUCS      M
*** x - x      (in)      (in/sec)   gm/cm3    lb/ft2     lb/ft2    lb/ft2.d
    1    38      0.0001    0.0001     2.2       0.06      0.3       0.01
END SILT-CLAY-PM

SSED-INIT
*** RCHRES      Suspended sed concs (mg/l)
*** x - x      Sand       Silt       Clay
    1    38      0.         8.         8.
END SSED-INIT

BED-INIT
*** RCHRES      BEDDEP  Initial bed composition
*** x - x      (ft)      Sand       Silt       Clay
    1    38      2.        0.38      0.46      0.16
END BED-INIT

GQ-GENDATA
*** RCHRES NGQL TPFG PHFG ROFG CDFG SDFG PYFG LAT
*** x - x
    1    38      2       2       2       2       2       2       0
END GQ-GENDATA

GQ-QALDATA

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USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

*** RCHRES                               GQID      DQAL      CONCID      CONV      QTYID
*** x - x                               concid
1   38COPPER                           0.02      mg/L     0.0353    mg
END GQ-QALDATA

GQ-QALFG
*** RCHRES HDRL OXID PHOT VOLT BIOD  GEN SDAS
*** x - x
1   38      0      0      0      0      0      0
END GQ-QALFG

GQ-GENDECAY
*** RCHRES      FSTDEC      THFST
*** x - x      (/day)
1   38      0.00001    1.07
END GQ-GENDECAY

GQ-KD
*** RCHRES                               Partition coefficients (1/mg)
*** x - x ADPM(1,1) ADPM(2,1) ADPM(3,1) ADPM(4,1) ADPM(5,1) ADPM(6,1)
1   38      0.0035      0.0035      0.0035      0.0035      0.0035
END GQ-KD

GQ-ADRATE
*** RCHRES      Adsorption/desorption rate parameters (/day)
*** x - x ADPM(1,2) ADPM(2,2) ADPM(3,2) ADPM(4,2) ADPM(5,2) ADPM(6,2)
1   38      2.5      2.5      2.5      0.001      0.001      0.001
END GQ-ADRATE

GQ-ADTHETA
*** RCHRES      Adsorption/desorption temp. correction parameters
*** x - x ADPM(1,3) ADPM(2,3) ADPM(3,3) ADPM(4,3) ADPM(5,3) ADPM(6,3)
1   38      1.07      1.07      1.07      1.07      1.07      1.07
END GQ-ADTHETA

GQ-SEDCONC
*** RCHRES  Initial concentrations on sediment (concu/mg)
*** x - x      SQAL1      SQAL2      SQAL3      SQAL4      SQAL5      SQAL6
1   38      0.        0.        0.        0.026      0.045      0.045
END GQ-SEDCONC

GQ-QALDATA
*** RCHRES                               GQID      DQAL      CONCID      CONV      QTYID
*** x - x                               concid
1   38HARD                            50.      mg/L     0.0353    mg
END GQ-QALDATA

GQ-QALFG
*** RCHRES HDRL OXID PHOT VOLT BIOD  GEN SDAS

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

*** x - x
    1   38    0    0    0    0    0    0    0
END GQ-QALFG

GQ-GENDECAY
*** RCHRES      FSTDEC      THFST
*** x - x      (/day)
    1   38    0.00001     1.07
END GQ-GENDECAY

GQ-KD
*** RCHRES          Partition coefficients (l/mg)
*** x - x ADPM(1,1) ADPM(2,1) ADPM(3,1) ADPM(4,1) ADPM(5,1) ADPM(6,1)
    1   38    0.0035     0.0035     0.0035     0.0035     0.0035     0.0035
END GQ-KD

GQ-ADRATE
*** RCHRES          Adsorption/desorption rate parameters (/day)
*** x - x ADPM(1,2) ADPM(2,2) ADPM(3,2) ADPM(4,2) ADPM(5,2) ADPM(6,2)
    1   38    2.5        2.5        2.5        0.001      0.001      0.001
END GQ-ADRATE

GQ-ADTHETA
*** RCHRES          Adsorption/desorption temp. correction parameters
*** x - x ADPM(1,3) ADPM(2,3) ADPM(3,3) ADPM(4,3) ADPM(5,3) ADPM(6,3)
    1   38    1.07       1.07       1.07       1.07       1.07       1.07
END GQ-ADTHETA

GQ-SEDCONC
*** RCHRES  Initial concentrations on sediment (concu/mg)
*** x - x     SQAL1     SQAL2     SQAL3     SQAL4     SQAL5     SQAL6
    1   38    0.         0.         0.         0.026     0.045     0.045
END GQ-SEDCONC

END RCHRES

FTABLES

FTABLE           1
rows cols
  8    4
depth      area      volume  outflow1 ***
  0.       6.73       0.        0.
  0.27     6.88       1.85     30.78
  2.72     8.27       20.4     1422.95
  4.08    11.34      32.16     2815.1
  5.1      26.72      58.83     3891.53
  6.12     27.87      86.67     7202.54
105.06    139.61     8371.89    4822380.

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

204.      251.34  27712.27 23862576.
END FTABLE 1

FTABLE      2
rows cols
8     4
depth      area      volume    outflowl ***
0.        9.76      0.          0.
0.27      9.98      2.69       18.92
2.72      11.99     29.58      874.37
4.08      16.44     46.64      1729.82
5.1       38.75     85.31      2391.27
6.12      40.42     125.68     4425.81
105.06    202.45    12140.222963249.75
204.      364.48    40186.03   14663044.
END FTABLE 2

FTABLE      3
rows cols
8     4
depth      area      volume    outflowl ***
0.        0.77      0.          0.
0.18      0.81      0.14       2.26
1.81      1.16      1.74       107.3
2.72      1.93      2.88       218.19
3.4       3.95      5.47       331.18
4.08      4.24      8.26       626.18
70.07    32.49     1220.17   649962.38
136.05   60.74     4295.853484127.75
END FTABLE 3

FTABLE      4
rows cols
8     4
depth      area      volume    outflowl ***
0.        1.11      0.          0.
0.18      1.17      0.21       3.15
1.81      1.67      2.52       149.08
2.72      2.8       4.17       303.15
3.4       5.72      7.92       460.15
4.08      6.14      11.95      870.02
70.07    47.02     1765.78   903059.81
136.05   87.89     6216.77   4840858.5
END FTABLE 4

FTABLE      5
rows cols
8     4
depth      area      volume    outflowl ***

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

      0.      2.06      0.      0.
      0.18     2.17     0.38     2.24
      1.81     3.11     4.69    106.2
      2.72      5.2     7.75   215.97
      3.4      10.63    14.71   327.81
      4.08     11.41    22.21   619.81
      70.07    87.38   3281.48 643349.63
     136.05   163.34  11553.1  3448680.
END FTABLE 5

FTABLE      6
rows cols
  8      4
depth      area      volume  outflow1 ***
      0.      0.75      0.      0.
      0.18     0.79     0.14     1.87
      1.81     1.13     1.7     88.76
      2.72     1.88     2.81   180.5
      3.4      3.85     5.33   273.98
      4.08     4.13     8.04   518.02
      70.07    31.65   1188.58 537697.25
     136.05   59.16   4184.642882329.75
END FTABLE 6

FTABLE      7
rows cols
  8      4
depth      area      volume  outflow1 ***
      0.      0.63      0.      0.
      0.18     0.66     0.12     2.42
      1.81     0.95     1.43   114.63
      2.72     1.59     2.36   233.11
      3.4      3.24     4.49   353.83
      4.08     3.48     6.78   669.
      70.07    26.66   1001.09 694412.06
     136.05   49.83   3524.543722400.75
END FTABLE 7

FTABLE      8
rows cols
  8      5
depth      area      volume  outflow1  outflow2 ***
      0.     12.24      0.      0.      0.
      0.27    12.52     3.37     0.    19.91
      2.72    15.03     37.08     0.   920.43
      4.08    20.61     58.47     0.  1820.95
      5.1     48.58    106.95     0.  2517.24
      6.12    50.67    157.56     0.  4658.96
     105.06   253.8   15219.64     0. 3119357.

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

    204.      456.93   50379.4          0.  15435510.
END FTABLE 8

FTABLE      9
rows cols
  8     4
depth      area      volume  outflow1 ***
  0.        2.57       0.        0.
  0.18      2.7        0.48      2.96
  1.81      3.86      5.83      140.1
  2.72      6.46      9.63      284.89
  3.4       13.21     18.29     432.42
  4.08      14.19     27.6      817.6
  70.07     108.6     4078.41   848652.31
 136.05     203.01    14358.84   4549206.5
END FTABLE 9

FTABLE      10
rows cols
  8     4
depth      area      volume  outflow1 ***
  0.        0.42       0.        0.
  0.18      0.44      0.08      3.36
  1.81      0.63      0.95      159.32
  2.72      1.06      1.58      323.97
  3.4       2.16      2.99      491.75
  4.08      2.32      4.52      929.77
  70.07     17.78     667.64    965081.88
 136.05     33.23    2350.55   5173328.
END FTABLE 10

FTABLE      11
rows cols
  8     5
depth      area      volume  outflow1  outflow2 ***
  0.        5.16       0.        0.        0.
  0.27      5.28      1.42      0.        15.84
  2.72      6.34      15.65     0.        732.39
  4.08      8.7       24.68     0.        1448.93
  5.1       20.5      45.14     0.        2002.97
  6.12      21.39     66.5      0.        3707.15
 105.06     107.13    6424.02    0.        2482079.
 204.       192.86    21264.53   0.        12282070.
END FTABLE 11

FTABLE      12
rows cols
  8     4
depth      area      volume  outflow1 ***

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

    0.      0.52      0.      0.
    0.18    0.55      0.1     3.23
    1.81    0.78      1.18    153.14
    2.72    1.31      1.95    311.42
    3.4     2.68      3.71    472.69
    4.08    2.88      5.6     893.73
    70.07   22.02     827.14  927678.06
    136.05  41.17     2912.12 4972824.5
END FTABLE 12

```

```

FTABLE      13
rows cols
8      4
depth      area      volume  outflow1 ***
0.        0.72      0.       0.
0.18      0.76      0.13    2.6
1.81      1.08      1.64    123.3
2.72      1.81      2.7     250.73
3.4       3.71      5.13    380.57
4.08      3.98      7.74    719.57
70.07     30.46     1144.02 746894.56
136.05   56.94     4027.73 4003733.5
END FTABLE 13

```

```

FTABLE      14
rows cols
8      4
depth      area      volume  outflow1 ***
0.        0.21      0.       0.
0.18      0.22      0.04    0.54
1.81      0.32      0.48    25.67
2.72      0.54      0.8     52.21
3.4       1.1       1.52    79.24
4.08      1.18      2.29    149.83
70.07     9.01      338.3   155516.8
136.05   16.84     1191.05 833648.81
END FTABLE 14

```

```

FTABLE      15
rows cols
8      4
depth      area      volume  outflow1 ***
0.        1.32      0.       0.
0.18      1.39      0.25    3.51
1.81      1.99      3.       166.31
2.72      3.32      4.95    338.19
3.4       6.79      9.4     513.33
4.08      7.29      14.19   970.57
70.07     55.81     2096.03 1007433.5

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

136.05      104.33    7379.47  5400354.
END FTABLE 15

FTABLE      16
rows cols
8      4
depth      area      volume   outflowl ***
0.        2.18      0.        0.
0.18       2.29      0.4      2.78
1.81       3.28      4.95     131.68
2.72       5.48      8.17     267.77
3.4        11.21     15.51    406.44
4.08       12.03     23.41    768.47
70.07      92.11     3459.2   797656.94
136.05     172.19    12178.8  4275845.5
END FTABLE 16

FTABLE      17
rows cols
8      4
depth      area      volume   outflowl ***
0.        3.03      0.        0.
0.27       3.1       0.83     14.12
2.72       3.73      9.19     652.67
4.08       5.11      14.5     1291.23
5.1        12.04     26.52    1784.96
6.12       12.56     39.07    3303.65
105.06     62.93     3773.49  2211921.5
204.       113.29    12490.84  10945248.
END FTABLE 17

FTABLE      18
rows cols
8      4
depth      area      volume   outflowl ***
0.        4.13      0.        0.
0.18       4.33      0.77     1.79
1.81       6.21      9.38     84.69
2.72       10.39     15.49    172.22
3.4        21.25     29.41    261.4
4.08       22.81     44.4     494.24
70.07      174.66    6559.59  513015.75
136.05     326.51    23094.35 2750024.5
END FTABLE 18

FTABLE      19
rows cols
8      4
depth      area      volume   outflowl ***

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

      0.      1.98      0.      0.
      0.27    2.03      0.55    7.02
      2.72    2.44      6.01   324.62
      4.08    3.34      9.48   642.22
      5.1     7.88     17.34   887.8
      6.12    8.21     25.54  1643.15
    105.06   41.15   2467.511100154.13
     204.    74.08   8167.84  5443891.

END FTABLE 19

FTABLE      20
rows cols
      8      5
      depth    area    volume  outflow1  outflow2 ***
      0.        9.5      0.        0.        0.
      0.27     9.71     2.61      0.       16.92
      2.72    11.66     28.77     0.      782.15
      4.08     16.        45.37     0.     1547.38
      5.1     37.69     82.99     0.     2139.07
      6.12    39.32     122.27     0.     3959.04
    105.06   196.94   11810.24     0.   2650731.
     204.    354.57   39093.73     0.  13116610.

END FTABLE 20

FTABLE      21
rows cols
      8      4
      depth    area    volume  outflow1 ***
      0.        2.38      0.        0.
      0.18     2.5       0.44      2.62
      1.81     3.59     5.42    124.17
      2.72     6.        8.95    252.5
      3.4      12.27    16.99    383.25
      4.08     13.18    25.65    724.63
    70.07    100.89   3789.16  752154.38
   136.05   188.61   13340.54031928.75

END FTABLE 21

FTABLE      22
rows cols
      8      4
      depth    area    volume  outflow1 ***
      0.        1.54      0.        0.
      0.18     1.62     0.29      2.11
      1.81     2.32     3.51     100.
      2.72     3.88     5.79    203.36
      3.4      7.94     11.        308.67
      4.08     8.53     16.6     583.62
    70.07    65.3     2452.53   605783.

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

136.05    122.08    8634.62  3247304.
END FTABLE 22

FTABLE      23
rows cols          ***
8     4
depth      area      volume   outflowl ***
0.        0.51       0.        0.
0.18      0.54       0.1       2.77
1.81      0.77       1.17     131.08
2.72      1.29       1.93     266.55
3.4       2.65       3.67     404.59
4.08      2.84       5.53     764.97
70.07     21.77     817.57   794028.13
136.05    40.7      2878.42  4256393.
END FTABLE 23

FTABLE      24
rows cols          ***
8     4
depth      area      volume   outflowl ***
0.        1.42       0.        0.
0.18      1.49       0.26     3.76
1.81      2.14       3.23     178.09
2.72      3.57       5.33     362.14
3.4       7.31       10.12    549.68
4.08      7.85       15.27    1039.31
70.07     60.09     2256.81078783.75
136.05    112.33    7945.49   5782827.5
END FTABLE 24

FTABLE      25
rows cols          ***
8     4
depth      area      volume   outflowl ***
0.        1.68       0.        0.
0.18      1.76       0.31     2.47
1.81      2.53       3.81     117.12
2.72      4.22       6.29     238.16
3.4       8.64       11.95    361.49
4.08      9.27       18.04    683.49
70.07     70.99     2665.99   709447.94
136.05    132.7     9386.153803000.75
END FTABLE 25

FTABLE      26
rows cols          ***
8     4
depth      area      volume   outflowl ***

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

    0.      0.55      0.      0.
    0.18    0.57      0.1     3.08
    1.81    0.82      1.24    145.93
    2.72    1.38      2.05    296.76
    3.4     2.81      3.9     450.45
    4.08    3.02      5.88    851.68
    70.07   23.14    868.98  884022.69
   136.05  43.25    3059.4   4738809.5
END FTABLE 26

FTABLE      27
rows cols
8      4
depth      area      volume  outflow1 ***
0.        25.85     0.        0.
0.27     26.44     7.11     12.12
2.72     31.75     78.33    560.3
4.08     43.55    123.52   1108.48
5.1      102.62   225.93   1532.34
6.12     107.04   332.86   2836.09
105.06   536.16   32152.11898873.38
204.     965.28   106428.48  9396193.
END FTABLE 27

```

```

FTABLE      28
rows cols
8      4
depth      area      volume  outflow1 ***
0.        12.65     0.        0.
0.27     12.94     3.48     12.12
2.72     15.54     38.34    560.28
4.08     21.32     60.46    1108.44
5.1      50.23     110.59   1532.28
6.12     52.4      162.93   2835.98
105.06   262.45   15738.481898796.63
204.     472.51   52096.84   9395813.
END FTABLE 28

```

```

FTABLE      29
rows cols
8      4
depth      area      volume  outflow1 ***
0.        1.4       0.        0.
0.18     1.48      0.26     4.04
1.81     2.12      3.19     191.41
2.72     3.54      5.27     389.25
3.4      7.23      10.01    590.83
4.08     7.77      15.12    1117.1
70.07   59.47    2233.37   1159527.

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

136.05    111.17    7863.02   6215652.
END FTABLE 29

FTABLE      30
rows cols          ***
8     4
depth      area      volume   outflow1 ***
0.        2.61       0.        0.
0.18      2.74       0.49     4.07
1.81      3.93       5.93     192.7
2.72      6.57       9.8      391.85
3.4       13.44      18.6     594.78
4.08      14.43      28.08    1124.58
70.07     110.48     4149.321167289.38
136.05    206.54     14608.5   6257263.
END FTABLE 30

FTABLE      31
rows cols          ***
8     4
depth      area      volume   outflow1 ***
0.        1.46       0.        0.
0.18      1.53       0.27     3.39
1.81      2.2        3.32     160.69
2.72      3.68       5.48     326.78
3.4       7.52       10.41    496.
4.08      8.08       15.72    937.81
70.07     61.85     2322.72   973433.
136.05    115.62     8177.58   5218094.5
END FTABLE 31

FTABLE      32
rows cols          ***
9     5
depth      area      volume   outflow1   outflow2 ***
0.        0.          0.        0.        0.
0.1       5.          1.2      0.        3.2
0.27     14.37      3.87     0.        13.2
2.72     17.26      42.58    0.        609.99
4.08     23.67      67.14    0.        1206.77
5.1      55.78      122.8   0.        1668.22
6.12     58.18      180.92  0.        3087.57
105.06    291.43     17476.16 0.        2067251.
204.      524.68     57848.82 0.        10229370.
END FTABLE 32

FTABLE      33
rows cols          ***
8     4

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

depth      area      volume   outflow1 ***
0.        38.32     0.        0.
0.27      39.19     10.54    12.23
2.72      47.06     116.12   565.25
4.08      64.55     183.1    1118.27
5.1       152.12    334.91   1545.88
6.12      158.68    493.42   2861.14
105.06    794.79   47661.411915645.38
204.      1430.91  157766.72  9479186.

END FTABLE 33

FTABLE      38
rows cols
8      4
depth      area      volume   outflow1 ***
0.        38.32     0.        0.
0.27      39.19     10.54    12.23
2.72      47.06     116.12   565.25
4.08      64.55     183.1    1118.27
5.1       152.12    334.91   1545.88
6.12      158.68    493.42   2861.14
105.06    794.79   47661.411915645.38
204.      1430.91  157766.72  9479186.

END FTABLE 38
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsyssGap<--Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name>  x <Name> x tem strg<-factor->strg <Name>  x  x  <Name> x x ***
*** Met Seg PC-100
WDM2      3 PREC      ENGL          SAME PERLND  11 209 EXTNL  PREC
WDM2      14 GATM     ENGL          AVER PERLND  11 209 EXTNL  GATMP
WDM2      13 PETI     ENGL          SAME PERLND  11 209 EXTNL  DTMPG
WDM2      13 PETI     ENGL          SAME PERLND  11 209 EXTNL  WINMOV
WDM2      13 PETI     ENGL          SAME PERLND  11 209 EXTNL  SOLRAD
WDM2      13 PETI     ENGL          AVER PERLND  11 209 EXTNL  PETINP
*** Met Seg PC-100
WDM2      3 PREC      ENGL          SAME PERLND  233 239 EXTNL  PREC
WDM2      14 GATM     ENGL          AVER PERLND  233 239 EXTNL  GATMP
WDM2      13 PETI     ENGL          SAME PERLND  233 239 EXTNL  DTMPG
WDM2      13 PETI     ENGL          SAME PERLND  233 239 EXTNL  WINMOV
WDM2      13 PETI     ENGL          SAME PERLND  233 239 EXTNL  SOLRAD
WDM2      13 PETI     ENGL          AVER PERLND  233 239 EXTNL  PETINP
*** Met Seg WFPC
WDM2      7 PREC      ENGL          SAME PERLND  214 229 EXTNL  PREC
WDM2      14 GATM     ENGL          AVER PERLND  214 229 EXTNL  GATMP
WDM2      13 PETI     ENGL          SAME PERLND  214 229 EXTNL  DTMPG
WDM2      13 PETI     ENGL          SAME PERLND  214 229 EXTNL  WINMOV
WDM2      13 PETI     ENGL          SAME PERLND  214 229 EXTNL  SOLRAD

```

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

WDM2	13	PETI	ENGL	AVER	PERLND	214	229	EXTNL	PETINP
*** Met	Seg	WFPC							
WDM2	7	PREC	ENGL	SAME	PERLND	244	375	EXTNL	PREC
WDM2	14	GATM	ENGL	AVER	PERLND	244	375	EXTNL	GATMP
WDM2	13	PETI	ENGL	SAME	PERLND	244	375	EXTNL	DTMPG
WDM2	13	PETI	ENGL	SAME	PERLND	244	375	EXTNL	WINMOV
WDM2	13	PETI	ENGL	SAME	PERLND	244	375	EXTNL	SOLRAD
WDM2	13	PETI	ENGL	AVER	PERLND	244	375	EXTNL	PETINP
*** Met	Seg	PC-100							
WDM2	3	PREC	ENGL	SAME	RCHRES	3	20	EXTNL	PREC
WDM2	14	GATM	ENGL	AVER	RCHRES	3	20	EXTNL	GATMP
WDM2	13	PETI	ENGL	SAME	RCHRES	3	20	EXTNL	DEWTMP
WDM2	13	PETI	ENGL	SAME	RCHRES	3	20	EXTNL	WIND
WDM2	13	PETI	ENGL	SAME	RCHRES	3	20	EXTNL	SOLRAD
WDM2	13	PETI	ENGL	SAME	RCHRES	3	20	EXTNL	CLOUD
WDM2	13	PETI	ENGL	AVER	RCHRES	3	20	EXTNL	POTEV
*** Met	Seg	PC-100							
WDM2	3	PREC	ENGL	SAME	RCHRES	23		EXTNL	PREC
WDM2	14	GATM	ENGL	AVER	RCHRES	23		EXTNL	GATMP
WDM2	13	PETI	ENGL	SAME	RCHRES	23		EXTNL	DEWTMP
WDM2	13	PETI	ENGL	SAME	RCHRES	23		EXTNL	WIND
WDM2	13	PETI	ENGL	SAME	RCHRES	23		EXTNL	SOLRAD
WDM2	13	PETI	ENGL	SAME	RCHRES	23		EXTNL	CLOUD
WDM2	13	PETI	ENGL	AVER	RCHRES	23		EXTNL	POTEV
*** Met	Seg	PC-100							
WDM2	3	PREC	ENGL	SAME	RCHRES	38		EXTNL	PREC
WDM2	14	GATM	ENGL	AVER	RCHRES	38		EXTNL	GATMP
WDM2	13	PETI	ENGL	SAME	RCHRES	38		EXTNL	DEWTMP
WDM2	13	PETI	ENGL	SAME	RCHRES	38		EXTNL	WIND
WDM2	13	PETI	ENGL	SAME	RCHRES	38		EXTNL	SOLRAD
WDM2	13	PETI	ENGL	SAME	RCHRES	38		EXTNL	CLOUD
WDM2	13	PETI	ENGL	AVER	RCHRES	38		EXTNL	POTEV
*** Met	Seg	WFPC							
WDM2	7	PREC	ENGL	SAME	RCHRES	21	22	EXTNL	PREC
WDM2	14	GATM	ENGL	AVER	RCHRES	21	22	EXTNL	GATMP
WDM2	13	PETI	ENGL	SAME	RCHRES	21	22	EXTNL	DEWTMP
WDM2	13	PETI	ENGL	SAME	RCHRES	21	22	EXTNL	WIND
WDM2	13	PETI	ENGL	SAME	RCHRES	21	22	EXTNL	SOLRAD
WDM2	13	PETI	ENGL	SAME	RCHRES	21	22	EXTNL	CLOUD
WDM2	13	PETI	ENGL	AVER	RCHRES	21	22	EXTNL	POTEV
*** Met	Seg	WFPC							
WDM2	7	PREC	ENGL	SAME	RCHRES	24	33	EXTNL	PREC
WDM2	14	GATM	ENGL	AVER	RCHRES	24	33	EXTNL	GATMP
WDM2	13	PETI	ENGL	SAME	RCHRES	24	33	EXTNL	DEWTMP
WDM2	13	PETI	ENGL	SAME	RCHRES	24	33	EXTNL	WIND
WDM2	13	PETI	ENGL	SAME	RCHRES	24	33	EXTNL	SOLRAD
WDM2	13	PETI	ENGL	SAME	RCHRES	24	33	EXTNL	CLOUD
WDM2	13	PETI	ENGL	AVER	RCHRES	24	33	EXTNL	POTEV
*** Met	Seg	PC-MC DI							

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

WDM2    19 PREC      ENGL          SAME RCHRES   1   2 EXTNL  PREC
WDM2    14 GATM      ENGL          AVER RCHRES   1   2 EXTNL  GATMP
WDM2    13 PETI      ENGL          SAME RCHRES   1   2 EXTNL  DEWTMP
WDM2    13 PETI      ENGL          SAME RCHRES   1   2 EXTNL  WIND
WDM2    13 PETI      ENGL          SAME RCHRES   1   2 EXTNL  SOLRAD
WDM2    13 PETI      ENGL          SAME RCHRES   1   2 EXTNL  CLOUD
WDM2    13 PETI      ENGL          AVER RCHRES   1   2 EXTNL  POTEV

WDM2    15 FLOW      ENGL          0.032 SAME RCHRES   7   INFLOW IVOL
WDM2    23 LOAD      ENGL          SAME RCHRES   7   INFLOW IDQAL  1 1
WDM2    24 LOAD      ENGL          SAME RCHRES   7   INFLOW IDQAL  2 1
END EXT SOURCES

```

SCHEMATIC

<-Volume->	<-Area-->	<-Volume->	<ML#>	***	<sb>
<Name> x	<-factor->	<Name> x		***	x x
PERLND 11	620.24	RCHRES	1	2	
PERLND 12	594.36	RCHRES	1	2	
PERLND 13	5	RCHRES	1	2	
PERLND 21	84.68	RCHRES	2	2	
PERLND 22	1204.95	RCHRES	2	2	
PERLND 23	5	RCHRES	2	2	
RCHRES 1		RCHRES	2	3	
PERLND 32	240.46	RCHRES	3	2	
PERLND 33	15.12	RCHRES	3	2	
PERLND 41	18.63	RCHRES	4	2	
PERLND 42	368.15	RCHRES	4	2	
PERLND 51	28.94	RCHRES	5	2	
PERLND 52	704.19	RCHRES	5	2	
PERLND 64	261	RCHRES	6	2	
PERLND 61	303.49	RCHRES	6	2	
PERLND 62	11.47	RCHRES	6	2	
PERLND 74	259.65	RCHRES	7	2	
PERLND 71	398.44	RCHRES	7	2	
PERLND 73	0.41	RCHRES	7	2	
RCHRES 2		RCHRES	8	3	
RCHRES 3		RCHRES	8	7	
RCHRES 4		RCHRES	8	3	
RCHRES 5		RCHRES	8	3	
RCHRES 6		RCHRES	11	3	
RCHRES 7		RCHRES	11	3	
PERLND 91	1184.22	RCHRES	9	2	
PERLND 92	4.28	RCHRES	9	2	
PERLND 93	5	RCHRES	9	2	
PERLND 97	5	RCHRES	9	2	
PERLND 105	2.93	RCHRES	10	2	
PERLND 106	9.87	RCHRES	10	2	
PERLND 107	68.37	RCHRES	10	2	
PERLND 101	34.71	RCHRES	10	2	

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

PERLND 103	14.45	RCHRES	10	2
PERLND 84	94.59	RCHRES	11	2
PERLND 81	1063.2	RCHRES	11	2
PERLND 82	223.59	RCHRES	11	2
PERLND 114	30.13	RCHRES	11	2
PERLND 116	49.05	RCHRES	11	2
PERLND 117	183.3	RCHRES	11	2
PERLND 118	131.14	RCHRES	11	2
PERLND 111	193.15	RCHRES	11	2
PERLND 112	123.09	RCHRES	11	2
PERLND 113	5	RCHRES	11	2
RCHRES 8		RCHRES	11	5
RCHRES 9		RCHRES	11	3
RCHRES 10		RCHRES	11	3
PERLND 129	2.27	RCHRES	12	2
PERLND 126	12.72	RCHRES	12	2
PERLND 127	151.6	RCHRES	12	2
PERLND 128	3.28	RCHRES	12	2
PERLND 122	8.62	RCHRES	12	2
PERLND 134	167.18	RCHRES	13	2
PERLND 135	10.91	RCHRES	13	2
PERLND 137	38.28	RCHRES	13	2
PERLND 133	0.09	RCHRES	13	2
PERLND 144	10.62	RCHRES	14	2
PERLND 149	5.48	RCHRES	14	2
PERLND 145	36.76	RCHRES	14	2
PERLND 147	6.61	RCHRES	14	2
PERLND 143	104.26	RCHRES	14	2
PERLND 157	1612.74	RCHRES	15	2
PERLND 167	1022.19	RCHRES	16	2
PERLND 168	106.71	RCHRES	16	2
PERLND 161	163.97	RCHRES	16	2
PERLND 162	163.57	RCHRES	16	2
PERLND 179	35.11	RCHRES	17	2
PERLND 177	471.89	RCHRES	17	2
PERLND 172	3.45	RCHRES	17	2
RCHRES 15		RCHRES	17	3
RCHRES 16		RCHRES	17	3
PERLND 189	1860.1	RCHRES	18	2
PERLND 187	4934.62	RCHRES	18	2
PERLND 188	664.34	RCHRES	18	2
PERLND 197	396.07	RCHRES	19	2
RCHRES 17		RCHRES	19	3
RCHRES 18		RCHRES	19	3
PERLND 209	483.01	RCHRES	20	2
PERLND 206	18.66	RCHRES	20	2
PERLND 207	1075.2	RCHRES	20	2
PERLND 208	87.72	RCHRES	20	2
PERLND 203	103.73	RCHRES	20	2

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

RCHRES	11		RCHRES	20	4
RCHRES	12		RCHRES	20	3
RCHRES	13		RCHRES	20	3
RCHRES	14		RCHRES	20	3
RCHRES	19		RCHRES	20	3
PERLND	214	111.22	RCHRES	21	2
PERLND	219	444.29	RCHRES	21	2
PERLND	217	739.03	RCHRES	21	2
PERLND	218	489.33	RCHRES	21	2
PERLND	224	272.7	RCHRES	22	2
PERLND	229	189.9	RCHRES	22	2
PERLND	225	110.89	RCHRES	22	2
PERLND	227	430.07	RCHRES	22	2
PERLND	228	742.76	RCHRES	22	2
PERLND	221	528.48	RCHRES	22	2
PERLND	222	303.83	RCHRES	22	2
PERLND	223	378.49	RCHRES	22	2
PERLND	234	24.74	RCHRES	23	2
PERLND	239	0.95	RCHRES	23	2
PERLND	237	113.44	RCHRES	23	2
PERLND	233	0.06	RCHRES	23	2
RCHRES	22		RCHRES	23	3
PERLND	244	0.6	RCHRES	24	2
PERLND	247	308.28	RCHRES	24	2
PERLND	254	115.54	RCHRES	25	2
PERLND	257	282.24	RCHRES	25	2
PERLND	258	91.61	RCHRES	25	2
PERLND	253	376.99	RCHRES	25	2
PERLND	264	67.22	RCHRES	26	2
PERLND	267	41.48	RCHRES	26	2
PERLND	263	53.42	RCHRES	26	2
RCHRES	25		RCHRES	26	3
PERLND	274	462.45	RCHRES	27	2
PERLND	279	3564.4	RCHRES	27	2
PERLND	277	4640.3	RCHRES	27	2
PERLND	278	4362.63	RCHRES	27	2
PERLND	271	4889.21	RCHRES	27	2
PERLND	284	1899.66	RCHRES	28	2
PERLND	289	3289.26	RCHRES	28	2
PERLND	288	794.33	RCHRES	28	2
PERLND	281	4108.5	RCHRES	28	2
PERLND	294	48.74	RCHRES	29	2
PERLND	299	429.23	RCHRES	29	2
PERLND	297	349.01	RCHRES	29	2
PERLND	298	929.89	RCHRES	29	2
PERLND	304	375.51	RCHRES	30	2
PERLND	309	482.33	RCHRES	30	2
PERLND	308	253.15	RCHRES	30	2
PERLND	301	228.46	RCHRES	30	2

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

PERLND	303		2.8	RCHRES	30	2
RCHRES	29			RCHRES	30	3
PERLND	314		333.07	RCHRES	31	2
PERLND	319		0.16	RCHRES	31	2
PERLND	311		491.42	RCHRES	31	2
PERLND	324		1357.59	RCHRES	32	2
PERLND	329		108.1	RCHRES	32	2
PERLND	327		1173.75	RCHRES	32	2
PERLND	321		147.06	RCHRES	32	2
PERLND	323		17.31	RCHRES	32	2
RCHRES	20			RCHRES	32	6
RCHRES	21			RCHRES	32	3
RCHRES	23			RCHRES	32	3
RCHRES	24			RCHRES	32	3
RCHRES	26			RCHRES	32	3
RCHRES	27			RCHRES	32	3
RCHRES	28			RCHRES	32	3
RCHRES	30			RCHRES	32	3
RCHRES	31			RCHRES	32	3
PERLND	334		16363.54	RCHRES	33	2
PERLND	339		3986.36	RCHRES	33	2
PERLND	337		8950.69	RCHRES	33	2
PERLND	331		23703.98	RCHRES	33	2
RCHRES	32			RCHRES	33	4
RCHRES	33			RCHRES	38	3
PERLND	344		147.48	RCHRES	38	2
PERLND	345		0.64	RCHRES	38	2
PERLND	341		244.99	RCHRES	38	2
PERLND	342		131.46	RCHRES	38	2
PERLND	343		33.18	RCHRES	38	2
PERLND	364		10.59	RCHRES	38	2
PERLND	365		11.31	RCHRES	38	2
PERLND	367		0.97	RCHRES	38	2
PERLND	354		22.37	RCHRES	38	2
PERLND	355		4.07	RCHRES	38	2
PERLND	351		13.93	RCHRES	38	2
PERLND	353		222.15	RCHRES	38	2
PERLND	374		104.28	RCHRES	38	2
PERLND	375		153.95	RCHRES	38	2
PERLND	372		5.89	RCHRES	38	2
PERLND	373		5.46	RCHRES	38	2
END SCHEMATIC						
EXT TARGETS						
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd ***						
<Name> x <Name> x x<-factor->strg <Name> x <Name>qf tem strg strg***						
PERLND	22	PWATER	PERO	1 1	202	WDM1 1004 FLOW 1 ENGL AGGR REPL
PERLND	22	PQUAL	POQC	1 1	0.03531	WDM1 2022 DQAL 1 ENGL AGGR REPL
RCHRES	1	GQUAL	DQAL	1 1	AVER WDM1 2001 DQAL	1 ENGL AGGR REPL

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

RCHRES    2 HYDR    RO     1 1      AVER WDM1  1001 FLOW   1 ENGL AGGR REPL
RCHRES    1 HYDR    RO     1 1      AVER WDM1  1006 FLOW   1 ENGL AGGR REPL
RCHRES    2 GQUAL   DQAL   1 1      AVER WDM1  2002 DQAL   1 ENGL AGGR REPL
RCHRES    3 HYDR    RO     1 1      AVER WDM1  1002 FLOW   1 ENGL AGGR REPL
RCHRES    3 GQUAL   DQAL   1 1      AVER WDM1  2003 DQAL   1 ENGL AGGR REPL
RCHRES    8 HYDR    IVOL   1 1      48.4SAME WDM1 1005 FLOW   1 ENGL AGGR REPL
RCHRES    8 GQUAL   DQAL   1 1      AVER WDM1  2008 DQAL   1 ENGL AGGR REPL
RCHRES    9 GQUAL   DQAL   1 1      AVER WDM1  2009 DQAL   1 ENGL AGGR REPL
RCHRES   11 GQUAL   DQAL   1 1      AVER WDM1  2011 DQAL   1 ENGL AGGR REPL
RCHRES   20 GQUAL   DQAL   1 1      AVER WDM1  2020 DQAL   1 ENGL AGGR REPL
RCHRES   20 HYDR    O      2 1      AVER WDM1  1003 FLOW   1 ENGL AGGR REPL
RCHRES   27 GQUAL   DQAL   1 1      AVER WDM1  2027 DQAL   1 ENGL AGGR REPL
RCHRES   32 GQUAL   DQAL   1 1      AVER WDM1  2032 DQAL   1 ENGL AGGR REPL
RCHRES   32 HYDR    O      2 1      AVER WDM1  1000 FLOW   1 ENGL AGGR REPL
END EXT TARGETS

```

MASS-LINK

MASS-LINK			1	<-Target vols> <-Grp> <-Member->			***		
<-Volume-> <-Grp> <-Member-><--Mult-->			<Name>	<Name> x x<-factor->			<Name>	<Name> x x	***
IMPLND	IWATER	SURO	0.0833333	RCHRES	INFLOW	IVOL			
IMPLND	IWTGAS	SODOXM		RCHRES	INFLOW	OXIF	1		
IMPLND	IWTGAS	SOCO2M		RCHRES	INFLOW	OXIF	2		
IMPLND	IWTGAS	SOHT		RCHRES	INFLOW	IHEAT	1		
IMPLND	SOLID	SOSLD	1	RCHRES	INFLOW	ISED	1		
IMPLND	SOLID	SOSLD	1	RCHRES	INFLOW	ISED	2		
IMPLND	SOLID	SOSLD	1	RCHRES	INFLOW	ISED	3		
IMPLND	IQUAL	SOQS	0.05	RCHRES	INFLOW	ISQAL	1 1		
IMPLND	IQUAL	SOQS	0.55	RCHRES	INFLOW	ISQAL	2 1		
IMPLND	IQUAL	SOQS	0.4	RCHRES	INFLOW	ISQAL	3 1		
IMPLND	IQUAL	SOQS	0.05	RCHRES	INFLOW	ISQAL	1 2		
IMPLND	IQUAL	SOQS	0.55	RCHRES	INFLOW	ISQAL	2 2		
IMPLND	IQUAL	SOQS	0.4	RCHRES	INFLOW	ISQAL	3 2		
END MASS-LINK			1						

MASS-LINK			3	<-Target vols> <-Grp> <-Member->			***		
<-Volume-> <-Grp> <-Member-><--Mult-->			<Name>	<Name> x x<-factor->			<Name>	<Name> x x	***
RCHRES	ROFLOW			RCHRES	INFLOW				
END MASS-LINK			3						

MASS-LINK			2	<-Target vols> <-Grp> <-Member->			***		
<-Volume-> <-Grp> <-Member-><--Mult-->			<Name>	<Name> x x<-factor->			<Name>	<Name> x x	***
PERLND	PWATER	PERO	0.0833333	RCHRES	INFLOW	IVOL			
PERLND	PWTGAS	PODOXM		RCHRES	INFLOW	OXIF	1		
PERLND	PWTGAS	POCO2M		RCHRES	INFLOW	OXIF	2		
PERLND	PWTGAS	POHT		RCHRES	INFLOW	IHEAT	1		

USER CONTROL INPUT FILE FOR THE HSPF CALIBRATION SCENARIO

```

PERLND      SEDMNT SOSED  1          RCHRES        INFLOW ISED   1
PERLND      SEDMNT SOSED  1          RCHRES        INFLOW ISED   2
PERLND      SEDMNT SOSED  1          RCHRES        INFLOW ISED   3
PERLND      PQUAL  SOQS   1          0.05        RCHRES        INFLOW ISQAL 1 1
PERLND      PQUAL  SOQS   1          0.55        RCHRES        INFLOW ISQAL 2 1
PERLND      PQUAL  SOQS   1          0.4         RCHRES        INFLOW ISQAL 3 1
PERLND      PQUAL  POQUAL 1          RCHRES        INFLOW IDQAL 1
END MASS-LINK 2

MASS-LINK      4
<-Volume-> <-Grp> <-Member-><-Mult--> <-Target vols> <-Grp> <-Member-> ***
<Name>           <Name> x x<-factor-> <Name>           <Name> x x ***

RCHRES      OFLOW    2          RCHRES        INFLOW
END MASS-LINK 4

MASS-LINK      5
<-Volume-> <-Grp> <-Member-><-Mult--> <-Target vols> <-Grp> <-Member-> ***
<Name>           <Name> x x<-factor-> <Name>           <Name> x x ***

RCHRES      ROFLOW   ROVOL  1 1      RCHRES        INFLOW IVOL   1 1
RCHRES      ROFLOW   RODQAL 1 1      0.4        RCHRES        INFLOW IDQAL 1 1
RCHRES      ROFLOW   RODQAL 2 1      RCHRES        INFLOW IDQAL 2 1
END MASS-LINK 5

MASS-LINK      6
<-Volume-> <-Grp> <-Member-><-Mult--> <-Target vols> <-Grp> <-Member-> ***
<Name>           <Name> x x<-factor-> <Name>           <Name> x x ***

RCHRES      ROFLOW   ROVOL  1 1      RCHRES        INFLOW IVOL   1 1
RCHRES      ROFLOW   RODQAL 1 1      0.6        RCHRES        INFLOW IDQAL 1 1
RCHRES      ROFLOW   RODQAL 1 1      RCHRES        INFLOW IDQAL 2 1
END MASS-LINK 6

MASS-LINK      7
<-Volume-> <-Grp> <-Member-><-Mult--> <-Target vols> <-Grp> <-Member-> ***
<Name>           <Name> x x<-factor-> <Name>           <Name> x x ***

RCHRES      ROFLOW   ROVOL  1 1      RCHRES        INFLOW IVOL   1 1
RCHRES      ROFLOW   RODQAL 1 1      0.8        RCHRES        INFLOW IDQAL 1 1
RCHRES      ROFLOW   RODQAL 1 1      RCHRES        INFLOW IDQAL 2 1
END MASS-LINK 7
END MASS-LINK

END RUN

```

Rating Curves Developed Using WinXSPRO

D

Pinto Creek Phase II TMDL Modeling Report

RATING CURVES DEVELOPED USING WINXSPRO

PINTO CREEK ABOVE GIBSON TRIBUTARY

*****WinXSPRO*****
M:\1761108\DATA\CROSSS~1\DATFIL~1\PCABOV~1\ABOVE_PC.OUT
Input File: M:\1761108\DATA\CROSSS~1\DATFIL~1\PC-100\PC-100~1.TXT
Run Date: 05/24/04
Analysis Procedure: Hydraulics & Regression
Cross Section Number: 1
Survey Date: 04/29/04
PC Above Gibson

Subsections/Dividing stations

A

Resistance Method: Manning's n

SECTION	A
Low Stage n	0.045
High Stage n	0.030

STAGE	#SEC	AREA	PERIM	WIDTH	R	DHYD	SLOPE	n	VAVG	Q	SHEAR
(ft)		(sq ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(cfs)	(psf)	
0.03	T	0.00	0.31	0.30	0.01	0.01	0.022	0.045	0.30	0.00	0.02
0.06	T	0.02	0.61	0.60	0.03	0.03	0.022	0.045	0.47	0.01	0.04
0.09	T	0.05	1.21	1.19	0.04	0.04	0.022	0.045	0.55	0.03	0.05
0.12	T	0.08	1.34	1.30	0.06	0.06	0.022	0.045	0.77	0.06	0.08
0.15	T	0.12	1.46	1.41	0.08	0.09	0.022	0.045	0.95	0.12	0.12
0.18	T	0.17	1.59	1.53	0.11	0.11	0.022	0.044	1.11	0.19	0.14
0.21	T	0.22	1.73	1.65	0.12	0.13	0.022	0.044	1.24	0.27	0.17
0.24	T	0.27	1.90	1.81	0.14	0.15	0.022	0.044	1.35	0.36	0.19
0.27	T	0.32	2.08	1.98	0.16	0.16	0.022	0.044	1.45	0.47	0.21
0.30	T	0.39	2.23	2.09	0.17	0.18	0.022	0.044	1.55	0.60	0.24
0.33	T	0.45	2.38	2.21	0.19	0.20	0.022	0.044	1.65	0.74	0.26
0.36	T	0.52	2.52	2.32	0.21	0.22	0.022	0.044	1.75	0.91	0.28
0.39	T	0.61	3.98	3.75	0.15	0.16	0.022	0.044	1.44	0.87	0.21
0.42	T	0.72	4.28	4.01	0.17	0.18	0.022	0.044	1.55	1.12	0.23
0.45	T	0.85	4.34	4.02	0.19	0.21	0.022	0.044	1.70	1.44	0.27
0.48	T	0.97	4.41	4.02	0.22	0.24	0.022	0.044	1.85	1.78	0.30
0.51	T	1.09	4.47	4.02	0.24	0.27	0.022	0.043	1.98	2.15	0.33
0.54	T	1.21	4.53	4.03	0.27	0.30	0.022	0.043	2.11	2.55	0.37
0.57	T	1.33	4.59	4.03	0.29	0.33	0.022	0.043	2.24	2.97	0.40
0.60	T	1.45	4.65	4.04	0.31	0.36	0.022	0.043	2.35	3.41	0.43
0.63	T	1.57	4.71	4.04	0.33	0.39	0.022	0.043	2.47	3.87	0.46
0.66	T	1.69	4.77	4.04	0.35	0.42	0.022	0.043	2.58	4.36	0.49
0.69	T	1.81	4.83	4.05	0.38	0.45	0.022	0.043	2.68	4.86	0.52
0.72	T	1.93	4.89	4.05	0.40	0.48	0.022	0.043	2.78	5.38	0.54
0.75	T	2.06	4.95	4.05	0.42	0.51	0.022	0.043	2.88	5.92	0.57
0.78	T	2.18	5.01	4.06	0.43	0.54	0.022	0.043	2.97	6.48	0.60
0.81	T	2.30	5.07	4.06	0.45	0.57	0.022	0.043	3.07	7.05	0.62
0.84	T	2.42	5.13	4.06	0.47	0.60	0.022	0.042	3.16	7.64	0.65
0.87	T	2.54	5.19	4.07	0.49	0.63	0.022	0.042	3.24	8.25	0.67
0.90	T	2.67	5.25	4.07	0.51	0.65	0.022	0.042	3.33	8.87	0.70

0.93 T	2.79	5.31	4.08	0.53	0.68	0.022	0.042	3.41	9.50	0.72
0.96 T	2.91	5.37	4.08	0.54	0.71	0.022	0.042	3.49	10.15	0.74
0.99 T	3.03	5.43	4.08	0.56	0.74	0.022	0.042	3.57	10.82	0.77
1.02 T	3.15	5.49	4.09	0.57	0.77	0.022	0.042	3.64	11.49	0.79
1.05 T	3.28	5.55	4.09	0.59	0.80	0.022	0.042	3.72	12.19	0.81
1.08 T	3.40	5.61	4.09	0.61	0.83	0.022	0.042	3.79	12.89	0.83
1.11 T	3.52	5.67	4.10	0.62	0.86	0.022	0.042	3.86	13.61	0.85
1.14 T	3.65	5.73	4.10	0.64	0.89	0.022	0.042	3.93	14.34	0.87
1.17 T	3.77	5.79	4.10	0.65	0.92	0.022	0.041	4.00	15.08	0.89
1.20 T	3.89	5.85	4.11	0.67	0.95	0.022	0.041	4.07	15.84	0.91
1.23 T	4.02	5.91	4.11	0.68	0.98	0.022	0.041	4.14	16.61	0.93
1.26 T	4.14	5.97	4.11	0.69	1.01	0.022	0.041	4.20	17.39	0.95
1.29 T	4.26	6.03	4.12	0.71	1.04	0.022	0.041	4.26	18.18	0.97
1.32 T	4.39	6.09	4.12	0.72	1.06	0.022	0.041	4.33	18.98	0.99
1.35 T	4.51	6.15	4.13	0.73	1.09	0.022	0.041	4.39	19.79	1.01
1.38 T	4.63	6.21	4.13	0.75	1.12	0.022	0.041	4.45	20.62	1.02
1.41 T	4.76	6.27	4.13	0.76	1.15	0.022	0.041	4.51	21.46	1.04
1.44 T	4.88	6.33	4.14	0.77	1.18	0.022	0.041	4.57	22.30	1.06
1.47 T	5.01	6.39	4.14	0.78	1.21	0.022	0.041	4.63	23.16	1.08
1.50 T	5.13	6.45	4.14	0.80	1.24	0.022	0.041	4.68	24.03	1.09
1.53 T	5.25	6.51	4.15	0.81	1.27	0.022	0.040	4.74	24.91	1.11
1.56 T	5.38	6.57	4.15	0.82	1.30	0.022	0.040	4.80	25.80	1.12
1.59 T	5.50	6.63	4.15	0.83	1.32	0.022	0.040	4.85	26.70	1.14
1.62 T	5.63	6.69	4.16	0.84	1.35	0.022	0.040	4.91	27.61	1.15
1.65 T	5.75	6.75	4.16	0.85	1.38	0.022	0.040	4.96	28.53	1.17
1.68 T	5.88	6.81	4.17	0.86	1.41	0.022	0.040	5.01	29.47	1.18
1.71 T	6.00	6.87	4.17	0.87	1.44	0.022	0.040	5.07	30.41	1.20
1.74 T	6.13	6.93	4.17	0.88	1.47	0.022	0.040	5.12	31.36	1.21
1.77 T	6.25	6.99	4.18	0.89	1.50	0.022	0.040	5.17	32.32	1.23
1.80 T	6.38	7.05	4.18	0.90	1.53	0.022	0.040	5.22	33.29	1.24
1.83 T	6.50	7.11	4.18	0.91	1.55	0.022	0.040	5.27	34.28	1.26
1.86 T	6.63	7.17	4.19	0.92	1.58	0.022	0.039	5.32	35.27	1.27
1.89 T	6.76	7.23	4.19	0.93	1.61	0.022	0.039	5.37	36.27	1.28
1.92 T	6.88	7.29	4.19	0.94	1.64	0.022	0.039	5.42	37.28	1.30
1.95 T	7.01	7.35	4.20	0.95	1.67	0.022	0.039	5.47	38.30	1.31
1.98 T	7.13	7.41	4.20	0.96	1.70	0.022	0.039	5.51	39.34	1.32
2.01 T	7.26	7.47	4.20	0.97	1.73	0.022	0.039	5.56	40.38	1.33
2.04 T	7.38	7.53	4.21	0.98	1.75	0.022	0.039	5.61	41.43	1.35
2.07 T	7.51	7.59	4.21	0.99	1.78	0.022	0.039	5.66	42.49	1.36
2.10 T	7.64	7.65	4.22	1.00	1.81	0.022	0.039	5.70	43.56	1.37
2.13 T	7.76	7.71	4.22	1.01	1.84	0.022	0.039	5.75	44.64	1.38
2.16 T	7.89	7.77	4.22	1.02	1.87	0.022	0.039	5.80	45.73	1.39
2.19 T	8.02	7.83	4.23	1.02	1.90	0.022	0.038	5.84	46.83	1.41
2.22 T	8.14	7.89	4.23	1.03	1.93	0.022	0.038	5.89	47.94	1.42
2.25 T	8.27	7.95	4.23	1.04	1.95	0.022	0.038	5.93	49.05	1.43
2.28 T	8.40	8.01	4.24	1.05	1.98	0.022	0.038	5.98	50.18	1.44
2.31 T	8.53	8.07	4.24	1.06	2.01	0.022	0.038	6.02	51.32	1.45
2.34 T	8.71	19.31	15.42	0.45	0.56	0.022	0.038	3.42	29.80	0.62
2.37 T	9.18	19.60	15.67	0.47	0.59	0.022	0.038	3.52	32.27	0.64
2.40 T	9.65	19.88	15.92	0.49	0.61	0.022	0.038	3.61	34.85	0.67
2.43 T	10.13	20.16	16.17	0.50	0.63	0.022	0.038	3.70	37.53	0.69
2.46 T	10.62	20.44	16.43	0.52	0.65	0.022	0.038	3.80	40.32	0.71
2.49 T	11.12	20.72	16.68	0.54	0.67	0.022	0.038	3.89	43.22	0.74
2.52 T	11.62	20.93	16.85	0.56	0.69	0.022	0.037	3.99	46.33	0.76
2.55 T	12.29	32.02	27.92	0.38	0.44	0.022	0.037	3.13	38.42	0.53
2.58 T	13.13	32.09	27.95	0.41	0.47	0.022	0.037	3.27	42.92	0.56

2.61 T	13.97	32.16	27.98	0.43	0.50	0.022	0.037	3.41	47.64	0.60
2.64 T	14.81	32.22	28.01	0.46	0.53	0.022	0.037	3.55	52.56	0.63
2.67 T	15.65	32.29	28.04	0.48	0.56	0.022	0.037	3.69	57.68	0.67
2.70 T	16.49	32.36	28.07	0.51	0.59	0.022	0.037	3.82	63.01	0.70
2.73 T	17.33	32.43	28.10	0.53	0.62	0.022	0.037	3.95	68.53	0.73
2.76 T	18.18	32.50	28.13	0.56	0.65	0.022	0.037	4.09	74.26	0.77
2.79 T	19.02	32.57	28.15	0.58	0.68	0.022	0.037	4.22	80.18	0.80
2.82 T	19.87	32.64	28.18	0.61	0.70	0.022	0.037	4.34	86.29	0.84
2.85 T	20.71	32.71	28.21	0.63	0.73	0.022	0.036	4.47	92.60	0.87
2.88 T	21.56	32.78	28.24	0.66	0.76	0.022	0.036	4.60	99.10	0.90
2.91 T	22.41	32.85	28.27	0.68	0.79	0.022	0.036	4.72	105.80	0.94
2.94 T	23.25	32.92	28.30	0.71	0.82	0.022	0.036	4.85	112.68	0.97
2.97 T	24.10	32.98	28.33	0.73	0.85	0.022	0.036	4.97	119.75	1.00
3.00 T	24.95	33.05	28.36	0.75	0.88	0.022	0.036	5.09	127.02	1.04
3.03 T	25.81	33.12	28.39	0.78	0.91	0.022	0.036	5.21	134.47	1.07
3.06 T	26.66	33.19	28.42	0.80	0.94	0.022	0.036	5.33	142.11	1.10
3.09 T	27.51	33.26	28.45	0.83	0.97	0.022	0.036	5.45	149.94	1.14
3.12 T	28.36	33.33	28.47	0.85	1.00	0.022	0.036	5.57	157.95	1.17
3.15 T	29.22	33.40	28.50	0.87	1.03	0.022	0.036	5.69	166.16	1.20
3.18 T	30.07	33.47	28.53	0.90	1.05	0.022	0.035	5.80	174.54	1.23
3.21 T	30.93	33.54	28.56	0.92	1.08	0.022	0.035	5.92	183.12	1.27
3.24 T	31.79	33.61	28.59	0.95	1.11	0.022	0.035	6.04	191.88	1.30
3.27 T	32.65	33.67	28.62	0.97	1.14	0.022	0.035	6.15	200.83	1.33
3.30 T	33.51	33.74	28.65	0.99	1.17	0.022	0.035	6.27	209.97	1.36
3.33 T	34.37	33.81	28.68	1.02	1.20	0.022	0.035	6.38	219.29	1.40
3.36 T	35.23	33.88	28.71	1.04	1.23	0.022	0.035	6.50	228.80	1.43
3.39 T	36.09	33.95	28.74	1.06	1.26	0.022	0.035	6.61	238.49	1.46
3.42 T	36.95	34.02	28.77	1.09	1.28	0.022	0.035	6.72	248.38	1.49
3.45 T	37.81	34.09	28.79	1.11	1.31	0.022	0.035	6.83	258.44	1.52
3.48 T	38.68	34.16	28.82	1.13	1.34	0.022	0.035	6.95	268.70	1.55
3.51 T	39.54	34.23	28.85	1.16	1.37	0.022	0.034	7.06	279.14	1.59
3.54 T	40.41	34.30	28.88	1.18	1.40	0.022	0.034	7.17	289.77	1.62
3.57 T	41.28	34.37	28.91	1.20	1.43	0.022	0.034	7.28	300.59	1.65
3.60 T	42.14	34.43	28.94	1.22	1.46	0.022	0.034	7.39	311.60	1.68
3.63 T	43.01	34.50	28.97	1.25	1.48	0.022	0.034	7.50	322.80	1.71
3.66 T	43.88	34.57	29.00	1.27	1.51	0.022	0.034	7.62	334.19	1.74
3.69 T	44.75	34.64	29.03	1.29	1.54	0.022	0.034	7.73	345.76	1.77
3.72 T	45.62	34.71	29.06	1.31	1.57	0.022	0.034	7.84	357.53	1.80
3.75 T	46.50	34.78	29.09	1.34	1.60	0.022	0.034	7.95	369.49	1.84
3.78 T	47.37	34.85	29.12	1.36	1.63	0.022	0.034	8.06	381.63	1.87
3.81 T	48.24	34.92	29.14	1.38	1.66	0.022	0.034	8.17	393.97	1.90
3.84 T	49.12	34.99	29.17	1.40	1.68	0.022	0.033	8.28	406.51	1.93
3.87 T	49.99	35.06	29.20	1.43	1.71	0.022	0.033	8.39	419.23	1.96
3.90 T	50.87	35.13	29.23	1.45	1.74	0.022	0.033	8.50	432.16	1.99
3.93 T	51.75	35.19	29.26	1.47	1.77	0.022	0.033	8.60	445.27	2.02
3.96 T	52.63	35.26	29.29	1.49	1.80	0.022	0.033	8.71	458.58	2.05
3.99 T	53.50	35.33	29.32	1.51	1.82	0.022	0.033	8.82	472.09	2.08
4.02 T	54.38	35.40	29.35	1.54	1.85	0.022	0.033	8.93	485.79	2.11
4.05 T	55.27	35.47	29.38	1.56	1.88	0.022	0.033	9.04	499.70	2.14
4.08 T	56.15	35.54	29.41	1.58	1.91	0.022	0.033	9.15	513.80	2.17
4.11 T	57.03	35.61	29.44	1.60	1.94	0.022	0.033	9.26	528.10	2.20
4.14 T	57.91	35.68	29.46	1.62	1.97	0.022	0.033	9.37	542.60	2.23
4.17 T	58.80	35.75	29.49	1.64	1.99	0.022	0.032	9.48	557.30	2.26
4.20 T	59.68	35.82	29.52	1.67	2.02	0.022	0.032	9.59	572.21	2.29
4.23 T	60.57	35.88	29.55	1.69	2.05	0.022	0.032	9.70	587.31	2.32
4.26 T	61.46	35.95	29.58	1.71	2.08	0.022	0.032	9.81	602.63	2.35
4.29 T	62.34	36.02	29.61	1.73	2.11	0.022	0.032	9.92	618.14	2.38

4.32 T	63.23	36.09	29.64	1.75	2.13	0.022	0.032	10.02	633.87	2.41
4.35 T	64.12	36.16	29.67	1.77	2.16	0.022	0.032	10.13	649.80	2.43
4.38 T	65.01	36.23	29.70	1.79	2.19	0.022	0.032	10.24	665.94	2.46
4.41 T	65.90	36.30	29.73	1.82	2.22	0.022	0.032	10.35	682.29	2.49
4.44 T	66.80	36.37	29.76	1.84	2.24	0.022	0.032	10.46	698.85	2.52
4.47 T	67.69	36.44	29.78	1.86	2.27	0.022	0.032	10.57	715.62	2.55
4.50 T	68.58	36.51	29.81	1.88	2.30	0.022	0.032	10.68	732.61	2.58
4.53 T	69.48	36.58	29.84	1.90	2.33	0.022	0.031	10.79	749.81	2.61
4.56 T	70.37	36.64	29.87	1.92	2.36	0.022	0.031	10.90	767.23	2.64
4.59 T	71.27	36.71	29.90	1.94	2.38	0.022	0.031	11.01	784.86	2.66
4.62 T	72.17	36.78	29.93	1.96	2.41	0.022	0.031	11.12	802.71	2.69
4.65 T	73.07	36.85	29.96	1.98	2.44	0.022	0.031	11.23	820.78	2.72
4.68 T	73.97	36.92	29.99	2.00	2.47	0.022	0.031	11.34	839.07	2.75
4.71 T	74.87	36.99	30.02	2.02	2.49	0.022	0.031	11.45	857.59	2.78
4.74 T	75.77	37.06	30.05	2.04	2.52	0.022	0.031	11.57	876.32	2.81
4.77 T	76.67	37.13	30.08	2.06	2.55	0.022	0.031	11.68	895.29	2.83
4.80 T	77.57	37.20	30.10	2.09	2.58	0.022	0.031	11.79	914.47	2.86
4.83 T	78.47	37.27	30.13	2.11	2.60	0.022	0.031	11.90	933.89	2.89
4.86 T	79.38	37.34	30.16	2.13	2.63	0.022	0.030	12.01	953.54	2.92
4.89 T	80.28	37.40	30.19	2.15	2.66	0.022	0.030	12.12	973.42	2.95
4.92 T	81.19	37.47	30.22	2.17	2.69	0.022	0.030	12.24	993.53	2.97
4.95 T	82.10	37.54	30.25	2.19	2.71	0.022	0.030	12.35	1013.87	3.00
4.98 T	83.01	37.61	30.28	2.21	2.74	0.022	0.030	12.46	1034.45	3.03

$Q = aR^b \quad a=111.628868 \quad b=2.755930 \quad r^2=0.917810 \quad n=166$
 $Q = aZ^b \quad a=9.932706 \quad b=2.548 \quad r^2=0.973701 \quad n=166$

GIBSON TRIBUTARY UPSTREAM OF CONFLUENCE WITH PINTO CREEK

*****WinXSPRO*****

M:\1761108\DATA\CROSSS~1\DATFIL~1\GIBSON\GIBSON.OUT

Input File: M:\1761108\DATA\CROSSS~1\DATFIL~1\GIBSON\GIBSON.TXT

Run Date: 05/24/04

Analysis Procedure: Hydraulics & Regression

Cross Section Number: 1

Survey Date: 04/13/04

Gibson Cross Section

Subsections/Dividing stations

A

Resistance Method: Manning's n

SECTION A

Low Stage	n	0.070
High Stage	n	0.045

STAGE	#SEC	AREA	PERIM	WIDTH	R	DHYD	SLOPE	n	VAVG	Q	SHEAR
(ft)		(sq ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)		(ft/s)	(cfs)	(psf)
0.03	T	0.00	0.06	0.01	0.00	0.01	0.057	0.070	0.09	0.00	0.01
0.06	T	0.00	0.13	0.03	0.01	0.02	0.057	0.070	0.16	0.00	0.02
0.09	T	0.00	0.19	0.06	0.01	0.03	0.057	0.070	0.24	0.00	0.04
0.12	T	0.00	0.26	0.09	0.02	0.05	0.057	0.069	0.33	0.00	0.06
0.15	T	0.01	0.33	0.11	0.02	0.06	0.057	0.069	0.40	0.00	0.08
0.18	T	0.01	0.39	0.14	0.03	0.08	0.057	0.069	0.47	0.01	0.10
0.21	T	0.02	0.46	0.17	0.03	0.09	0.057	0.069	0.54	0.01	0.12
0.24	T	0.02	0.53	0.20	0.04	0.11	0.057	0.069	0.61	0.01	0.14
0.27	T	0.03	0.59	0.23	0.05	0.12	0.057	0.069	0.67	0.02	0.17
0.30	T	0.03	0.66	0.25	0.05	0.14	0.057	0.069	0.73	0.03	0.19
0.33	T	0.04	0.83	0.37	0.05	0.12	0.057	0.069	0.73	0.03	0.19
0.36	T	0.06	1.03	0.51	0.06	0.11	0.057	0.068	0.76	0.04	0.20
0.39	T	0.08	1.29	0.73	0.06	0.10	0.057	0.068	0.78	0.06	0.21
0.42	T	0.10	1.68	1.07	0.06	0.10	0.057	0.068	0.81	0.08	0.22
0.45	T	0.14	2.08	1.41	0.07	0.10	0.057	0.068	0.86	0.12	0.24
0.48	T	0.19	2.41	1.70	0.08	0.11	0.057	0.068	0.95	0.18	0.28
0.51	T	0.24	2.65	1.89	0.09	0.13	0.057	0.068	1.06	0.26	0.32
0.54	T	0.30	3.28	2.48	0.09	0.12	0.057	0.068	1.08	0.33	0.33
0.57	T	0.38	3.35	2.52	0.11	0.15	0.057	0.068	1.23	0.47	0.40
0.60	T	0.46	3.42	2.57	0.13	0.18	0.057	0.067	1.38	0.63	0.47
0.63	T	0.53	3.50	2.61	0.15	0.20	0.057	0.067	1.51	0.81	0.54
0.66	T	0.61	3.57	2.65	0.17	0.23	0.057	0.067	1.64	1.00	0.61
0.69	T	0.69	3.65	2.70	0.19	0.26	0.057	0.067	1.75	1.21	0.68
0.72	T	0.77	3.72	2.74	0.21	0.28	0.057	0.067	1.87	1.45	0.74
0.75	T	0.86	3.80	2.78	0.23	0.31	0.057	0.067	1.98	1.69	0.80
0.78	T	0.94	3.87	2.83	0.24	0.33	0.057	0.067	2.08	1.96	0.86
0.81	T	1.03	3.94	2.87	0.26	0.36	0.057	0.066	2.18	2.24	0.93
0.84	T	1.11	4.02	2.92	0.28	0.38	0.057	0.066	2.28	2.54	0.99
0.87	T	1.20	4.09	2.96	0.29	0.41	0.057	0.066	2.37	2.85	1.04
0.90	T	1.29	4.17	3.00	0.31	0.43	0.057	0.066	2.47	3.18	1.10
0.93	T	1.38	4.24	3.05	0.33	0.45	0.057	0.066	2.55	3.53	1.16
0.96	T	1.47	4.32	3.09	0.34	0.48	0.057	0.066	2.64	3.89	1.21
0.99	T	1.57	4.39	3.13	0.36	0.50	0.057	0.066	2.73	4.27	1.27
1.02	T	1.66	4.47	3.18	0.37	0.52	0.057	0.066	2.81	4.67	1.32
1.05	T	1.76	5.33	4.01	0.33	0.44	0.057	0.065	2.60	4.58	1.18

1.08 T	1.88	5.40	4.05	0.35	0.47	0.057	0.065	2.70	5.09	1.24
1.11 T	2.00	5.47	4.09	0.37	0.49	0.057	0.065	2.80	5.61	1.30
1.14 T	2.13	5.54	4.12	0.38	0.52	0.057	0.065	2.89	6.16	1.37
1.17 T	2.25	5.61	4.16	0.40	0.54	0.057	0.065	2.99	6.72	1.43
1.20 T	2.38	5.97	4.48	0.40	0.53	0.057	0.065	2.98	7.09	1.42
1.23 T	2.52	6.38	4.86	0.39	0.52	0.057	0.065	2.96	7.47	1.40
1.26 T	2.67	6.79	5.23	0.39	0.51	0.057	0.064	2.96	7.92	1.40
1.29 T	2.84	7.20	5.61	0.39	0.51	0.057	0.064	2.97	8.42	1.40
1.32 T	3.01	7.61	5.98	0.40	0.50	0.057	0.064	2.98	8.98	1.41
1.35 T	3.19	8.20	6.53	0.39	0.49	0.057	0.064	2.96	9.46	1.39
1.38 T	3.40	9.13	7.42	0.37	0.46	0.057	0.064	2.88	9.81	1.33
1.41 T	3.64	9.80	8.06	0.37	0.45	0.057	0.064	2.88	10.46	1.32
1.44 T	3.89	10.47	8.71	0.37	0.45	0.057	0.064	2.89	11.22	1.32
1.47 T	4.16	11.14	9.35	0.37	0.44	0.057	0.064	2.90	12.07	1.33
1.50 T	4.45	11.81	10.00	0.38	0.45	0.057	0.063	2.93	13.01	1.34
1.53 T	4.76	12.48	10.64	0.38	0.45	0.057	0.063	2.95	14.06	1.36
1.56 T	5.08	12.86	10.98	0.40	0.46	0.057	0.063	3.03	15.42	1.41
1.59 T	5.42	13.10	11.16	0.41	0.49	0.057	0.063	3.13	16.97	1.47
1.62 T	5.75	13.33	11.34	0.43	0.51	0.057	0.063	3.23	18.59	1.54
1.65 T	6.10	13.57	11.52	0.45	0.53	0.057	0.063	3.33	20.27	1.60
1.68 T	6.45	13.80	11.70	0.47	0.55	0.057	0.063	3.42	22.04	1.66
1.71 T	6.80	13.93	11.79	0.49	0.58	0.057	0.063	3.53	23.99	1.74
1.74 T	7.15	14.00	11.82	0.51	0.60	0.057	0.062	3.64	26.07	1.82
1.77 T	7.51	14.08	11.86	0.53	0.63	0.057	0.062	3.76	28.22	1.90
1.80 T	7.86	14.15	11.89	0.56	0.66	0.057	0.062	3.87	30.45	1.98
1.83 T	8.22	14.22	11.93	0.58	0.69	0.057	0.062	3.98	32.74	2.06
1.86 T	8.58	14.30	11.96	0.60	0.72	0.057	0.062	4.09	35.11	2.13
1.89 T	8.94	14.37	12.00	0.62	0.75	0.057	0.062	4.20	37.54	2.21
1.92 T	9.30	15.06	12.65	0.62	0.74	0.057	0.062	4.19	38.98	2.20
1.95 T	9.71	16.96	14.52	0.57	0.67	0.057	0.061	3.99	38.75	2.04
1.98 T	10.15	17.03	14.55	0.60	0.70	0.057	0.061	4.11	41.67	2.12
2.01 T	10.58	17.10	14.58	0.62	0.73	0.057	0.061	4.22	44.68	2.20
2.04 T	11.02	17.17	14.61	0.64	0.75	0.057	0.061	4.34	47.78	2.28
2.07 T	11.46	17.24	14.63	0.66	0.78	0.057	0.061	4.45	50.96	2.36
2.10 T	11.90	17.31	14.66	0.69	0.81	0.057	0.061	4.56	54.23	2.44
2.13 T	12.34	17.38	14.69	0.71	0.84	0.057	0.061	4.67	57.59	2.53
2.16 T	12.78	17.45	14.72	0.73	0.87	0.057	0.061	4.78	61.03	2.61
2.19 T	13.22	17.52	14.75	0.75	0.90	0.057	0.060	4.88	64.56	2.68
2.22 T	13.66	17.59	14.77	0.78	0.92	0.057	0.060	4.99	68.17	2.76
2.25 T	14.11	17.66	14.80	0.80	0.95	0.057	0.060	5.09	71.87	2.84
2.28 T	14.55	17.73	14.83	0.82	0.98	0.057	0.060	5.20	75.65	2.92
2.31 T	15.00	17.87	14.93	0.84	1.00	0.057	0.060	5.29	79.30	2.99
2.34 T	15.45	18.16	15.19	0.85	1.02	0.057	0.060	5.35	82.62	3.03
2.37 T	15.91	18.44	15.45	0.86	1.03	0.057	0.060	5.41	86.05	3.07
2.40 T	16.38	18.73	15.70	0.87	1.04	0.057	0.059	5.47	89.58	3.11
2.43 T	16.85	19.01	15.96	0.89	1.06	0.057	0.059	5.53	93.21	3.15
2.46 T	17.33	19.30	16.22	0.90	1.07	0.057	0.059	5.59	96.95	3.19
2.49 T	17.83	19.59	16.47	0.91	1.08	0.057	0.059	5.65	100.80	3.24
2.52 T	18.32	19.87	16.73	0.92	1.10	0.057	0.059	5.72	104.75	3.28
2.55 T	18.83	20.16	16.99	0.93	1.11	0.057	0.059	5.78	108.82	3.32
2.58 T	19.34	20.44	17.24	0.95	1.12	0.057	0.059	5.84	113.00	3.37
2.61 T	19.86	20.73	17.50	0.96	1.14	0.057	0.059	5.90	117.29	3.41
2.64 T	20.39	20.95	17.69	0.97	1.15	0.057	0.058	5.98	121.96	3.46
2.67 T	20.92	21.03	17.73	0.99	1.18	0.057	0.058	6.08	127.26	3.54
2.70 T	21.46	21.11	17.77	1.02	1.21	0.057	0.058	6.18	132.67	3.62
2.73 T	21.99	21.19	17.81	1.04	1.23	0.057	0.058	6.28	138.18	3.69
2.76 T	22.52	21.27	17.85	1.06	1.26	0.057	0.058	6.38	143.80	3.77

2.79 T	23.06	21.58	18.11	1.07	1.27	0.057	0.058	6.44	148.48	3.80
2.82 T	23.62	22.34	18.81	1.06	1.26	0.057	0.058	6.41	151.28	3.76
2.85 T	24.19	22.87	19.29	1.06	1.25	0.057	0.058	6.42	155.35	3.76
2.88 T	24.77	22.95	19.33	1.08	1.28	0.057	0.057	6.52	161.60	3.84
2.91 T	25.35	23.03	19.37	1.10	1.31	0.057	0.057	6.63	167.95	3.91
2.94 T	25.93	23.11	19.42	1.12	1.34	0.057	0.057	6.73	174.42	3.99
2.97 T	26.51	23.19	19.46	1.14	1.36	0.057	0.057	6.83	181.01	4.07
3.00 T	27.10	23.27	19.50	1.16	1.39	0.057	0.057	6.93	187.71	4.14
3.03 T	27.68	23.35	19.54	1.19	1.42	0.057	0.057	7.03	194.53	4.22
3.06 T	28.27	23.43	19.59	1.21	1.44	0.057	0.057	7.13	201.46	4.29
3.09 T	28.86	23.51	19.63	1.23	1.47	0.057	0.056	7.22	208.50	4.37
3.12 T	29.45	23.59	19.67	1.25	1.50	0.057	0.056	7.32	215.66	4.44
3.15 T	30.04	23.67	19.71	1.27	1.52	0.057	0.056	7.42	222.94	4.51
3.18 T	30.63	23.75	19.76	1.29	1.55	0.057	0.056	7.52	230.33	4.59
3.21 T	31.23	23.83	19.80	1.31	1.58	0.057	0.056	7.62	237.84	4.66
3.24 T	31.82	23.91	19.84	1.33	1.60	0.057	0.056	7.71	245.47	4.73
3.27 T	32.42	23.99	19.89	1.35	1.63	0.057	0.056	7.81	253.21	4.81
3.30 T	33.01	24.07	19.93	1.37	1.66	0.057	0.056	7.91	261.07	4.88
3.33 T	33.61	24.15	19.97	1.39	1.68	0.057	0.055	8.00	269.05	4.95
3.36 T	34.21	24.23	20.01	1.41	1.71	0.057	0.055	8.10	277.15	5.02
3.39 T	34.81	24.31	20.06	1.43	1.74	0.057	0.055	8.20	285.36	5.09
3.42 T	35.41	24.39	20.10	1.45	1.76	0.057	0.055	8.29	293.70	5.16
3.45 T	36.02	24.47	20.14	1.47	1.79	0.057	0.055	8.39	302.15	5.23
3.48 T	36.62	24.55	20.19	1.49	1.81	0.057	0.055	8.48	310.72	5.31
3.51 T	37.23	24.63	20.23	1.51	1.84	0.057	0.055	8.58	319.42	5.38
3.54 T	37.84	24.71	20.27	1.53	1.87	0.057	0.054	8.68	328.23	5.45
3.57 T	38.45	24.79	20.31	1.55	1.89	0.057	0.054	8.77	337.17	5.52
3.60 T	39.06	24.87	20.36	1.57	1.92	0.057	0.054	8.87	346.23	5.58
3.63 T	39.67	24.95	20.40	1.59	1.94	0.057	0.054	8.96	355.41	5.65
3.66 T	40.28	25.03	20.44	1.61	1.97	0.057	0.054	9.05	364.72	5.72
3.69 T	40.89	25.11	20.49	1.63	2.00	0.057	0.054	9.15	374.14	5.79
3.72 T	41.51	25.19	20.53	1.65	2.02	0.057	0.054	9.24	383.70	5.86
3.75 T	42.13	25.27	20.57	1.67	2.05	0.057	0.054	9.34	393.37	5.93
3.78 T	42.74	25.35	20.61	1.69	2.07	0.057	0.053	9.43	403.18	6.00
3.81 T	43.36	25.43	20.66	1.70	2.10	0.057	0.053	9.53	413.11	6.06
3.84 T	43.98	25.51	20.70	1.72	2.12	0.057	0.053	9.62	423.16	6.13
3.87 T	44.60	25.64	20.81	1.74	2.14	0.057	0.053	9.70	432.81	6.19
3.90 T	45.23	25.77	20.93	1.76	2.16	0.057	0.053	9.79	442.60	6.24
3.93 T	45.86	25.90	21.04	1.77	2.18	0.057	0.053	9.87	452.54	6.30
3.96 T	46.49	26.03	21.15	1.79	2.20	0.057	0.053	9.95	462.61	6.35
3.99 T	47.13	26.16	21.26	1.80	2.22	0.057	0.052	10.03	472.84	6.41
4.02 T	47.77	26.29	21.38	1.82	2.23	0.057	0.052	10.12	483.21	6.46
4.05 T	48.41	26.42	21.49	1.83	2.25	0.057	0.052	10.20	493.73	6.52
4.08 T	49.06	26.55	21.60	1.85	2.27	0.057	0.052	10.28	504.40	6.57
4.11 T	49.71	26.67	21.72	1.86	2.29	0.057	0.052	10.36	515.22	6.63
4.14 T	50.36	26.80	21.83	1.88	2.31	0.057	0.052	10.45	526.20	6.68
4.17 T	51.02	26.93	21.94	1.89	2.33	0.057	0.052	10.53	537.33	6.74
4.20 T	51.68	27.06	22.06	1.91	2.34	0.057	0.052	10.62	548.61	6.79
4.23 T	52.34	27.19	22.17	1.93	2.36	0.057	0.051	10.70	560.06	6.85
4.26 T	53.01	27.32	22.28	1.94	2.38	0.057	0.051	10.78	571.66	6.90
4.29 T	53.68	27.45	22.39	1.96	2.40	0.057	0.051	10.87	583.42	6.96
4.32 T	54.35	27.58	22.51	1.97	2.41	0.057	0.051	10.95	595.34	7.01
4.35 T	55.03	27.71	22.62	1.99	2.43	0.057	0.051	11.04	607.43	7.06
4.38 T	55.71	27.83	22.73	2.00	2.45	0.057	0.051	11.12	619.68	7.12
4.41 T	56.39	27.96	22.85	2.02	2.47	0.057	0.051	11.21	632.10	7.17
4.44 T	57.08	28.09	22.96	2.03	2.49	0.057	0.051	11.29	644.69	7.23
4.47 T	57.77	28.22	23.07	2.05	2.50	0.057	0.050	11.38	657.45	7.28

4.50	T	58.46	28.35	23.19	2.06	2.52	0.057	0.050	11.47	670.38	7.33
4.53	T	59.16	28.48	23.30	2.08	2.54	0.057	0.050	11.55	683.48	7.39
4.56	T	59.86	28.61	23.41	2.09	2.56	0.057	0.050	11.64	696.75	7.44
4.59	T	60.57	28.74	23.52	2.11	2.57	0.057	0.050	11.73	710.21	7.50
4.62	T	61.27	28.87	23.64	2.12	2.59	0.057	0.050	11.81	723.84	7.55
4.65	T	61.98	29.00	23.75	2.14	2.61	0.057	0.050	11.90	737.65	7.60
4.68	T	62.70	29.12	23.86	2.15	2.63	0.057	0.049	11.99	751.64	7.66
4.71	T	63.42	29.25	23.98	2.17	2.64	0.057	0.049	12.08	765.82	7.71
4.74	T	64.14	29.38	24.09	2.18	2.66	0.057	0.049	12.16	780.18	7.76
4.77	T	64.86	29.51	24.20	2.20	2.68	0.057	0.049	12.25	794.73	7.82
4.80	T	65.59	29.64	24.32	2.21	2.70	0.057	0.049	12.34	809.47	7.87
4.83	T	66.32	29.77	24.43	2.23	2.71	0.057	0.049	12.43	824.40	7.92
4.86	T	67.06	29.90	24.54	2.24	2.73	0.057	0.049	12.52	839.52	7.98
4.89	T	67.79	30.03	24.66	2.26	2.75	0.057	0.049	12.61	854.84	8.03
4.92	T	68.53	30.16	24.77	2.27	2.77	0.057	0.048	12.70	870.35	8.08
4.95	T	69.28	30.28	24.88	2.29	2.78	0.057	0.048	12.79	886.06	8.14
4.98	T	70.03	30.41	24.99	2.30	2.80	0.057	0.048	12.88	901.97	8.19
5.01	T	70.78	30.54	25.11	2.32	2.82	0.057	0.048	12.97	918.08	8.24
5.04	T	71.53	30.66	25.20	2.33	2.84	0.057	0.048	13.07	934.73	*
8.30											
5.07	T	72.29	30.74	25.24	2.35	2.86	0.057	0.048	13.17	952.23	*
8.37											
5.10	T	73.05	30.82	25.28	2.37	2.89	0.057	0.048	13.28	969.91	*
8.43											
5.13	T	73.81	30.90	25.32	2.39	2.92	0.057	0.047	13.38	987.79	*
8.50											
5.16	T	74.57	30.98	25.36	2.41	2.94	0.057	0.047	13.49	1005.86	*
8.56											
5.19	T	75.33	31.06	25.40	2.43	2.97	0.057	0.047	13.60	1024.12	*
8.63											
5.22	T	76.09	31.14	25.44	2.44	2.99	0.057	0.047	13.70	1042.57	*
8.69											
5.25	T	76.85	31.22	25.48	2.46	3.02	0.057	0.047	13.81	1061.22	*
8.76											
5.28	T	77.62	31.30	25.52	2.48	3.04	0.057	0.047	13.91	1080.07	*
8.82											
5.31	T	78.39	31.38	25.56	2.50	3.07	0.057	0.047	14.02	1099.12	*
8.89											
5.34	T	79.15	31.46	25.60	2.52	3.09	0.057	0.047	14.13	1118.36	*
8.95											
5.37	T	79.92	31.54	25.64	2.53	3.12	0.057	0.046	14.24	1137.81	*
9.01											
5.40	T	80.69	31.62	25.68	2.55	3.14	0.057	0.046	14.34	1157.46	*
9.08											
5.43	T	81.46	31.70	25.72	2.57	3.17	0.057	0.046	14.45	1177.31	*
9.14											
5.46	T	82.23	31.78	25.76	2.59	3.19	0.057	0.046	14.56	1197.37	*
9.20											
5.49	T	83.01	31.86	25.80	2.61	3.22	0.057	0.046	14.67	1217.64	*
9.27											
5.52	T	83.78	31.94	25.84	2.62	3.24	0.057	0.046	14.78	1238.12	*
9.33											
5.55	T	84.56	32.02	25.88	2.64	3.27	0.057	0.046	14.89	1258.80	*
9.39											
5.58	T	85.33	32.10	25.92	2.66	3.29	0.057	0.046	15.00	1279.70	*
9.46											

5.61	T	86.11	32.18	25.96	2.68	3.32	0.057	0.045	15.11	1300.81	*
9.52											
5.64	T	86.89	32.26	26.00	2.69	3.34	0.057	0.045	15.22	1322.14	*
9.58											
5.67	T	87.67	32.34	26.04	2.71	3.37	0.057	0.045	15.33	1343.68	*
9.64											
5.70	T	88.45	32.42	26.08	2.73	3.39	0.057	0.045	15.44	1365.45	*
9.71											
5.73	T	89.24	32.49	26.12	2.75	3.42	0.057	0.045	15.55	1387.43	*
9.77											
5.76	T	90.02	32.57	26.16	2.76	3.44	0.057	0.045	15.66	1409.63	*
9.83											
5.79	T	90.81	32.65	26.20	2.78	3.47	0.057	0.045	15.77	1432.06	*
9.89											
5.82	T	91.59	32.73	26.24	2.80	3.49	0.057	0.044	15.88	1454.72	*
9.95											
5.85	T	92.38	32.81	26.28	2.82	3.52	0.057	0.044	15.99	1477.60	*
10.01											
5.88	T	93.17	32.89	26.32	2.83	3.54	0.057	0.044	16.11	1500.71	*
10.07											
5.91	T	93.96	32.97	26.36	2.85	3.57	0.057	0.044	16.22	1524.06	*
10.13											
5.94	T	94.75	33.05	26.40	2.87	3.59	0.057	0.044	16.33	1547.63	*
10.20											
5.97	T	95.54	33.13	26.44	2.88	3.61	0.057	0.044	16.45	1571.45	*
10.26											

$Q = aR^b \quad a=108.244118 \quad b=2.652173 \quad r^2=0.995554 \quad n=199$
 $Q = aZ^b \quad a=3.239908 \quad b=3.594 \quad r^2=0.996874 \quad n=199$

PINTO CREEK AT PC-100

*****WinXSPRO*****
M:\1761108\DATA\CROSSS~1\DATFIL~1\PC-100\PC-100.OUT
Input File: M:\1761108\DATA\CROSSS~1\DATFIL~1\PC-100\PC-100~1.TXT
Run Date: 05/24/04
Analysis Procedure: Hydraulics & Regression
Cross Section Number: 1
Survey Date: 04/29/04
PC Above Gibson

Subsections/Dividing stations

A

Resistance Method: Manning's n

SECTION	A
Low Stage n	0.045
High Stage n	0.030

STAGE	#SEC	AREA	PERIM	WIDTH	R	DHYD	SLOPE	n	VAVG	Q	SHEAR
(ft)		(sq ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)		(ft/s)	(cfs)	(psf)
0.03	T	0.00	0.31	0.30	0.01	0.01	0.022	0.045	0.30	0.00	0.02
0.06	T	0.02	0.61	0.60	0.03	0.03	0.022	0.045	0.47	0.01	0.04
0.09	T	0.05	1.21	1.19	0.04	0.04	0.022	0.045	0.55	0.03	0.05
0.12	T	0.08	1.34	1.30	0.06	0.06	0.022	0.045	0.77	0.06	0.08
0.15	T	0.12	1.46	1.41	0.08	0.09	0.022	0.045	0.95	0.12	0.12
0.18	T	0.17	1.59	1.53	0.11	0.11	0.022	0.044	1.11	0.19	0.14
0.21	T	0.22	1.73	1.65	0.12	0.13	0.022	0.044	1.24	0.27	0.17
0.24	T	0.27	1.90	1.81	0.14	0.15	0.022	0.044	1.35	0.36	0.19
0.27	T	0.32	2.08	1.98	0.16	0.16	0.022	0.044	1.45	0.47	0.21
0.30	T	0.39	2.23	2.09	0.17	0.18	0.022	0.044	1.55	0.60	0.24
0.33	T	0.45	2.38	2.21	0.19	0.20	0.022	0.044	1.65	0.74	0.26
0.36	T	0.52	2.52	2.32	0.21	0.22	0.022	0.044	1.75	0.91	0.28
0.39	T	0.61	3.98	3.75	0.15	0.16	0.022	0.044	1.44	0.87	0.21
0.42	T	0.72	4.28	4.01	0.17	0.18	0.022	0.044	1.55	1.12	0.23
0.45	T	0.85	4.34	4.02	0.19	0.21	0.022	0.044	1.70	1.44	0.27
0.48	T	0.97	4.41	4.02	0.22	0.24	0.022	0.044	1.85	1.78	0.30
0.51	T	1.09	4.47	4.02	0.24	0.27	0.022	0.043	1.98	2.15	0.33
0.54	T	1.21	4.53	4.03	0.27	0.30	0.022	0.043	2.11	2.55	0.37
0.57	T	1.33	4.59	4.03	0.29	0.33	0.022	0.043	2.24	2.97	0.40
0.60	T	1.45	4.65	4.04	0.31	0.36	0.022	0.043	2.35	3.41	0.43
0.63	T	1.57	4.71	4.04	0.33	0.39	0.022	0.043	2.47	3.87	0.46
0.66	T	1.69	4.77	4.04	0.35	0.42	0.022	0.043	2.58	4.36	0.49
0.69	T	1.81	4.83	4.05	0.38	0.45	0.022	0.043	2.68	4.86	0.52
0.72	T	1.93	4.89	4.05	0.40	0.48	0.022	0.043	2.78	5.38	0.54
0.75	T	2.06	4.95	4.05	0.42	0.51	0.022	0.043	2.88	5.92	0.57
0.78	T	2.18	5.01	4.06	0.43	0.54	0.022	0.043	2.97	6.48	0.60
0.81	T	2.30	5.07	4.06	0.45	0.57	0.022	0.043	3.07	7.05	0.62
0.84	T	2.42	5.13	4.06	0.47	0.60	0.022	0.042	3.16	7.64	0.65
0.87	T	2.54	5.19	4.07	0.49	0.63	0.022	0.042	3.24	8.25	0.67
0.90	T	2.67	5.25	4.07	0.51	0.65	0.022	0.042	3.33	8.87	0.70
0.93	T	2.79	5.31	4.08	0.53	0.68	0.022	0.042	3.41	9.50	0.72
0.96	T	2.91	5.37	4.08	0.54	0.71	0.022	0.042	3.49	10.15	0.74
0.99	T	3.03	5.43	4.08	0.56	0.74	0.022	0.042	3.57	10.82	0.77
1.02	T	3.15	5.49	4.09	0.57	0.77	0.022	0.042	3.64	11.49	0.79
1.05	T	3.28	5.55	4.09	0.59	0.80	0.022	0.042	3.72	12.19	0.81

1.08 T	3.40	5.61	4.09	0.61	0.83	0.022	0.042	3.79	12.89	0.83
1.11 T	3.52	5.67	4.10	0.62	0.86	0.022	0.042	3.86	13.61	0.85
1.14 T	3.65	5.73	4.10	0.64	0.89	0.022	0.042	3.93	14.34	0.87
1.17 T	3.77	5.79	4.10	0.65	0.92	0.022	0.041	4.00	15.08	0.89
1.20 T	3.89	5.85	4.11	0.67	0.95	0.022	0.041	4.07	15.84	0.91
1.23 T	4.02	5.91	4.11	0.68	0.98	0.022	0.041	4.14	16.61	0.93
1.26 T	4.14	5.97	4.11	0.69	1.01	0.022	0.041	4.20	17.39	0.95
1.29 T	4.26	6.03	4.12	0.71	1.04	0.022	0.041	4.26	18.18	0.97
1.32 T	4.39	6.09	4.12	0.72	1.06	0.022	0.041	4.33	18.98	0.99
1.35 T	4.51	6.15	4.13	0.73	1.09	0.022	0.041	4.39	19.79	1.01
1.38 T	4.63	6.21	4.13	0.75	1.12	0.022	0.041	4.45	20.62	1.02
1.41 T	4.76	6.27	4.13	0.76	1.15	0.022	0.041	4.51	21.46	1.04
1.44 T	4.88	6.33	4.14	0.77	1.18	0.022	0.041	4.57	22.30	1.06
1.47 T	5.01	6.39	4.14	0.78	1.21	0.022	0.041	4.63	23.16	1.08
1.50 T	5.13	6.45	4.14	0.80	1.24	0.022	0.041	4.68	24.03	1.09
1.53 T	5.25	6.51	4.15	0.81	1.27	0.022	0.040	4.74	24.91	1.11
1.56 T	5.38	6.57	4.15	0.82	1.30	0.022	0.040	4.80	25.80	1.12
1.59 T	5.50	6.63	4.15	0.83	1.32	0.022	0.040	4.85	26.70	1.14
1.62 T	5.63	6.69	4.16	0.84	1.35	0.022	0.040	4.91	27.61	1.15
1.65 T	5.75	6.75	4.16	0.85	1.38	0.022	0.040	4.96	28.53	1.17
1.68 T	5.88	6.81	4.17	0.86	1.41	0.022	0.040	5.01	29.47	1.18
1.71 T	6.00	6.87	4.17	0.87	1.44	0.022	0.040	5.07	30.41	1.20
1.74 T	6.13	6.93	4.17	0.88	1.47	0.022	0.040	5.12	31.36	1.21
1.77 T	6.25	6.99	4.18	0.89	1.50	0.022	0.040	5.17	32.32	1.23
1.80 T	6.38	7.05	4.18	0.90	1.53	0.022	0.040	5.22	33.29	1.24
1.83 T	6.50	7.11	4.18	0.91	1.55	0.022	0.040	5.27	34.28	1.26
1.86 T	6.63	7.17	4.19	0.92	1.58	0.022	0.039	5.32	35.27	1.27
1.89 T	6.76	7.23	4.19	0.93	1.61	0.022	0.039	5.37	36.27	1.28
1.92 T	6.88	7.29	4.19	0.94	1.64	0.022	0.039	5.42	37.28	1.30
1.95 T	7.01	7.35	4.20	0.95	1.67	0.022	0.039	5.47	38.30	1.31
1.98 T	7.13	7.41	4.20	0.96	1.70	0.022	0.039	5.51	39.34	1.32
2.01 T	7.26	7.47	4.20	0.97	1.73	0.022	0.039	5.56	40.38	1.33
2.04 T	7.38	7.53	4.21	0.98	1.75	0.022	0.039	5.61	41.43	1.35
2.07 T	7.51	7.59	4.21	0.99	1.78	0.022	0.039	5.66	42.49	1.36
2.10 T	7.64	7.65	4.22	1.00	1.81	0.022	0.039	5.70	43.56	1.37
2.13 T	7.76	7.71	4.22	1.01	1.84	0.022	0.039	5.75	44.64	1.38
2.16 T	7.89	7.77	4.22	1.02	1.87	0.022	0.039	5.80	45.73	1.39
2.19 T	8.02	7.83	4.23	1.02	1.90	0.022	0.038	5.84	46.83	1.41
2.22 T	8.14	7.89	4.23	1.03	1.93	0.022	0.038	5.89	47.94	1.42
2.25 T	8.27	7.95	4.23	1.04	1.95	0.022	0.038	5.93	49.05	1.43
2.28 T	8.40	8.01	4.24	1.05	1.98	0.022	0.038	5.98	50.18	1.44
2.31 T	8.53	8.07	4.24	1.06	2.01	0.022	0.038	6.02	51.32	1.45
2.34 T	8.71	19.31	15.42	0.45	0.56	0.022	0.038	3.42	29.80	0.62
2.37 T	9.18	19.60	15.67	0.47	0.59	0.022	0.038	3.52	32.27	0.64
2.40 T	9.65	19.88	15.92	0.49	0.61	0.022	0.038	3.61	34.85	0.67
2.43 T	10.13	20.16	16.17	0.50	0.63	0.022	0.038	3.70	37.53	0.69
2.46 T	10.62	20.44	16.43	0.52	0.65	0.022	0.038	3.80	40.32	0.71
2.49 T	11.12	20.72	16.68	0.54	0.67	0.022	0.038	3.89	43.22	0.74
2.52 T	11.62	20.93	16.85	0.56	0.69	0.022	0.037	3.99	46.33	0.76
2.55 T	12.29	32.02	27.92	0.38	0.44	0.022	0.037	3.13	38.42	0.53
2.58 T	13.13	32.09	27.95	0.41	0.47	0.022	0.037	3.27	42.92	0.56
2.61 T	13.97	32.16	27.98	0.43	0.50	0.022	0.037	3.41	47.64	0.60
2.64 T	14.81	32.22	28.01	0.46	0.53	0.022	0.037	3.55	52.56	0.63
2.67 T	15.65	32.29	28.04	0.48	0.56	0.022	0.037	3.69	57.68	0.67
2.70 T	16.49	32.36	28.07	0.51	0.59	0.022	0.037	3.82	63.01	0.70
2.73 T	17.33	32.43	28.10	0.53	0.62	0.022	0.037	3.95	68.53	0.73
2.76 T	18.18	32.50	28.13	0.56	0.65	0.022	0.037	4.09	74.26	0.77

2.79 T	19.02	32.57	28.15	0.58	0.68	0.022	0.037	4.22	80.18	0.80
2.82 T	19.87	32.64	28.18	0.61	0.70	0.022	0.037	4.34	86.29	0.84
2.85 T	20.71	32.71	28.21	0.63	0.73	0.022	0.036	4.47	92.60	0.87
2.88 T	21.56	32.78	28.24	0.66	0.76	0.022	0.036	4.60	99.10	0.90
2.91 T	22.41	32.85	28.27	0.68	0.79	0.022	0.036	4.72	105.80	0.94
2.94 T	23.25	32.92	28.30	0.71	0.82	0.022	0.036	4.85	112.68	0.97
2.97 T	24.10	32.98	28.33	0.73	0.85	0.022	0.036	4.97	119.75	1.00
3.00 T	24.95	33.05	28.36	0.75	0.88	0.022	0.036	5.09	127.02	1.04
3.03 T	25.81	33.12	28.39	0.78	0.91	0.022	0.036	5.21	134.47	1.07
3.06 T	26.66	33.19	28.42	0.80	0.94	0.022	0.036	5.33	142.11	1.10
3.09 T	27.51	33.26	28.45	0.83	0.97	0.022	0.036	5.45	149.94	1.14
3.12 T	28.36	33.33	28.47	0.85	1.00	0.022	0.036	5.57	157.95	1.17
3.15 T	29.22	33.40	28.50	0.87	1.03	0.022	0.036	5.69	166.16	1.20
3.18 T	30.07	33.47	28.53	0.90	1.05	0.022	0.035	5.80	174.54	1.23
3.21 T	30.93	33.54	28.56	0.92	1.08	0.022	0.035	5.92	183.12	1.27
3.24 T	31.79	33.61	28.59	0.95	1.11	0.022	0.035	6.04	191.88	1.30
3.27 T	32.65	33.67	28.62	0.97	1.14	0.022	0.035	6.15	200.83	1.33
3.30 T	33.51	33.74	28.65	0.99	1.17	0.022	0.035	6.27	209.97	1.36
3.33 T	34.37	33.81	28.68	1.02	1.20	0.022	0.035	6.38	219.29	1.40
3.36 T	35.23	33.88	28.71	1.04	1.23	0.022	0.035	6.50	228.80	1.43
3.39 T	36.09	33.95	28.74	1.06	1.26	0.022	0.035	6.61	238.49	1.46
3.42 T	36.95	34.02	28.77	1.09	1.28	0.022	0.035	6.72	248.38	1.49
3.45 T	37.81	34.09	28.79	1.11	1.31	0.022	0.035	6.83	258.44	1.52
3.48 T	38.68	34.16	28.82	1.13	1.34	0.022	0.035	6.95	268.70	1.55
3.51 T	39.54	34.23	28.85	1.16	1.37	0.022	0.034	7.06	279.14	1.59
3.54 T	40.41	34.30	28.88	1.18	1.40	0.022	0.034	7.17	289.77	1.62
3.57 T	41.28	34.37	28.91	1.20	1.43	0.022	0.034	7.28	300.59	1.65
3.60 T	42.14	34.43	28.94	1.22	1.46	0.022	0.034	7.39	311.60	1.68
3.63 T	43.01	34.50	28.97	1.25	1.48	0.022	0.034	7.50	322.80	1.71
3.66 T	43.88	34.57	29.00	1.27	1.51	0.022	0.034	7.62	334.19	1.74
3.69 T	44.75	34.64	29.03	1.29	1.54	0.022	0.034	7.73	345.76	1.77
3.72 T	45.62	34.71	29.06	1.31	1.57	0.022	0.034	7.84	357.53	1.80
3.75 T	46.50	34.78	29.09	1.34	1.60	0.022	0.034	7.95	369.49	1.84
3.78 T	47.37	34.85	29.12	1.36	1.63	0.022	0.034	8.06	381.63	1.87
3.81 T	48.24	34.92	29.14	1.38	1.66	0.022	0.034	8.17	393.97	1.90
3.84 T	49.12	34.99	29.17	1.40	1.68	0.022	0.033	8.28	406.51	1.93
3.87 T	49.99	35.06	29.20	1.43	1.71	0.022	0.033	8.39	419.23	1.96
3.90 T	50.87	35.13	29.23	1.45	1.74	0.022	0.033	8.50	432.16	1.99
3.93 T	51.75	35.19	29.26	1.47	1.77	0.022	0.033	8.60	445.27	2.02
3.96 T	52.63	35.26	29.29	1.49	1.80	0.022	0.033	8.71	458.58	2.05
3.99 T	53.50	35.33	29.32	1.51	1.82	0.022	0.033	8.82	472.09	2.08
4.02 T	54.38	35.40	29.35	1.54	1.85	0.022	0.033	8.93	485.79	2.11
4.05 T	55.27	35.47	29.38	1.56	1.88	0.022	0.033	9.04	499.70	2.14
4.08 T	56.15	35.54	29.41	1.58	1.91	0.022	0.033	9.15	513.80	2.17
4.11 T	57.03	35.61	29.44	1.60	1.94	0.022	0.033	9.26	528.10	2.20
4.14 T	57.91	35.68	29.46	1.62	1.97	0.022	0.033	9.37	542.60	2.23
4.17 T	58.80	35.75	29.49	1.64	1.99	0.022	0.032	9.48	557.30	2.26
4.20 T	59.68	35.82	29.52	1.67	2.02	0.022	0.032	9.59	572.21	2.29
4.23 T	60.57	35.88	29.55	1.69	2.05	0.022	0.032	9.70	587.31	2.32
4.26 T	61.46	35.95	29.58	1.71	2.08	0.022	0.032	9.81	602.63	2.35
4.29 T	62.34	36.02	29.61	1.73	2.11	0.022	0.032	9.92	618.14	2.38
4.32 T	63.23	36.09	29.64	1.75	2.13	0.022	0.032	10.02	633.87	2.41
4.35 T	64.12	36.16	29.67	1.77	2.16	0.022	0.032	10.13	649.80	2.43
4.38 T	65.01	36.23	29.70	1.79	2.19	0.022	0.032	10.24	665.94	2.46
4.41 T	65.90	36.30	29.73	1.82	2.22	0.022	0.032	10.35	682.29	2.49
4.44 T	66.80	36.37	29.76	1.84	2.24	0.022	0.032	10.46	698.85	2.52
4.47 T	67.69	36.44	29.78	1.86	2.27	0.022	0.032	10.57	715.62	2.55

4.50 T	68.58	36.51	29.81	1.88	2.30	0.022	0.032	10.68	732.61	2.58
4.53 T	69.48	36.58	29.84	1.90	2.33	0.022	0.031	10.79	749.81	2.61
4.56 T	70.37	36.64	29.87	1.92	2.36	0.022	0.031	10.90	767.23	2.64
4.59 T	71.27	36.71	29.90	1.94	2.38	0.022	0.031	11.01	784.86	2.66
4.62 T	72.17	36.78	29.93	1.96	2.41	0.022	0.031	11.12	802.71	2.69
4.65 T	73.07	36.85	29.96	1.98	2.44	0.022	0.031	11.23	820.78	2.72
4.68 T	73.97	36.92	29.99	2.00	2.47	0.022	0.031	11.34	839.07	2.75
4.71 T	74.87	36.99	30.02	2.02	2.49	0.022	0.031	11.45	857.59	2.78
4.74 T	75.77	37.06	30.05	2.04	2.52	0.022	0.031	11.57	876.32	2.81
4.77 T	76.67	37.13	30.08	2.06	2.55	0.022	0.031	11.68	895.29	2.83
4.80 T	77.57	37.20	30.10	2.09	2.58	0.022	0.031	11.79	914.47	2.86
4.83 T	78.47	37.27	30.13	2.11	2.60	0.022	0.031	11.90	933.89	2.89
4.86 T	79.38	37.34	30.16	2.13	2.63	0.022	0.030	12.01	953.54	2.92
4.89 T	80.28	37.40	30.19	2.15	2.66	0.022	0.030	12.12	973.42	2.95
4.92 T	81.19	37.47	30.22	2.17	2.69	0.022	0.030	12.24	993.53	2.97
4.95 T	82.10	37.54	30.25	2.19	2.71	0.022	0.030	12.35	1013.87	3.00
4.98 T	83.01	37.61	30.28	2.21	2.74	0.022	0.030	12.46	1034.45	3.03

$Q = aR^b$ $a=111.628868$ $b=2.755930$ $r^2=0.917810$ $n=166$

$Q = aZ^b$ $a=9.932706$ $b=2.548$ $r^2=0.973701$ $n=166$

Appendix F
ADEQ Station Name Cross Reference

F

Pinto Creek Phase II TMDL Modeling Report

Appendix F
ADEQ Station Name Cross Reference

ADEQ Site ID	ADEQ Numeric ID	Station Name	Previous ADEQ ID
SRPNT008.48	100346	Pinto Creek - Above Henderson Ford	
SRPNT032.25	101039	Pinto Creek - Above Henderson Ranch Mines	
SRPNT031.74	101061	Pinto Creek - Below Henderson Ranch Mines	
SRPNT028.85	101062	Pinto Creek - Above Gibson Mine tributary	
SRPNT028.62	101063	Pinto Creek - Below Gibson Mine tributary	
SRPNT027.51	101064	Pinto Creek - At Old Highway 60	PC-100
SRPNT020.12	101068	Pinto Creek - At USGS gage below Haunted Canyon	PC-200
SRPNT014.51	101070	USGS 09498501 Pinto Creek - At USGS gage, Pinto Valley Weir	PC-300
SRGIB000.11	101071	Gibson Mine tributary - At Pinto Creek	PC-GIB
SRHNC000.14	101072	Haunted Canyon - Carlota Weir	
SRHNC000.45	101131	Haunted Canyon - Below Powers Gulch	
SRPNT033.02	102428	PINTO CREEK - AT SIMPSON DAM	
SRPNT031.89	102429	PINTO CREEK - AT HENDERSON RANCH MINES	
SRPNT024.04	102430	PINTO CREEK - ABOVE CARLOTA CACTUS BRECCIA	
SRPNT023.29	102431	PINTO CREEK - BELOW CARLOTA CACTUS BRECCIA	
SRPNT019.77	102432	PINTO CREEK - BELOW USGS GAGE 09498501 BELOW HAUNTED CANYON	
SRWPN004.47	102433	WEST FORK PINTO CREEK - BELOW KENNEDY RANCH	
SRWPN000.39	102434	WEST FORK PINTO CREEK - AT WF	
SRWPN000.01	102435	WEST FORK PINTO CREEK - AT MOUTH	
SRPNT014.93	102436	PINTO CREEK - ABOVE USGS GAGE 09498502 AT PINTO VALLEY WEIR	
SRPNT004.37	102437	PINTO CREEK - AT STATE ROUTE 188	
SRERT000.48	102647	ELLIS RANCH TRIBUTARY - ABOVE FOREST ROAD 349	
SRERT000.10	102648	ELLIS RANCH TRIBUTARY - AT FOREST SERVICE ROAD 349	
SRUP1000.02	102649	UNNAMED TRIB TO PINTO CREEK (UP1) - AT BLUE GATE	
SRUP2000.07	102650	UNNNAME TRIB TO PINTO CREEK (UP2) - SITE D	
SRUP3000.05	102651	UNNAME TRIB TO PINTO CREEK (UP3) - SITE C	
SRUP4000.01	102652	UNNAME TRIB TO PINTO CREEK (UP4) - SITE B	
SRUP5000.01	102653	UNNAME TRIB TO PINTO CREEK (UP5) - SITE A	
SRUP6000.01	102654	UNNAME TRIB TO PINTO CREEK (UP6) - AT FOREST ROAD #2	
SRMEC001.13	102655	MEAD CANYON - BELOW MF RANCH	
SRMEC000.53	102656	MEAD CANYON - AT FOREST ROAD #349	
SRFPM002.24	102657	FIVE POINT MOUNTAIN TRIBUTARY - 60W3	
SRFPM001.69	102658	FIVE PIONT MOUNTAIN TRIBUTARY - BELOW UNNAME MINE	
SRFPM000.99	102659	FIVE POINT MOUNTAIN TRIBUTARY - ABOVE BROX MINE	
SRFPM000.90	102660	FIVE POINT MOUNTAIN TRIBUTARY - BELOW BROX MINE	
SRUP7000.45	102661	UNNAME TRIB TO PINTO CREEK (UP7) - AT BHP NPDES 005 OUTFALL	
SRUP7000.48	102662	UNNAME TRIB TO PINTO CREEK (UP7) - ABOVE BHP NPDES 005 OUTFALL	
SRUP8000.34	102663	UNNAME TRIB TO PINTO CREEK (UP8) - NEAR CARLOTA MINE	
SRUP9000.13	102664	UNNAME TRIB TO PINTO CREEK (UP9) - NEAR OLD MILL AT CARLOTA MINE	
SRPWG000.15	102665	POWERS GULCH - NEAR HAUNTED CANYON	
SRGDG000.03	102666	GOLD GULCH - AT WEIR	
SRMMB000.22	102667	MOVING MACHINE BASIN TRIBUTARY - NEAR PINTO CREEK	
SRJKM000.22	102668	JK MOUNTAIN TRIBUTARY - ABOVE WEST FORK PINTO CREEK	
SRUUF000.10	102687	UNNAMED TRIB TO UF1 (UUF) - 60W2	
SRUF1000.57	102688	UNNAMED TRIB TO 5 PT MTN TRIB (UF1) - 60W1	
SRUF2000.06	102689	UNNAMED TRIB TO 5 PT MTN TRIB (UF2) - AUTO SAMPLER SITE	
SRUF3000.30	102690	UNNAMED TRIB TO 5 PT MTN TRIB (UF3) - ABOVE BROX MINE	
SRUPA000.42	102941	UNNAMED TRIB TO PINTO CREEK (UPA) - ABOVE RIPPER SPRING TRIBUTARY	



**MALCOLM
PIRNIE**